

AD-A088 341

ROME AIR DEVELOPMENT CENTER GRIFFISS AFB NY
INDUSTRY LOOKS AT RADC - 1980. VOLUME III.(U)

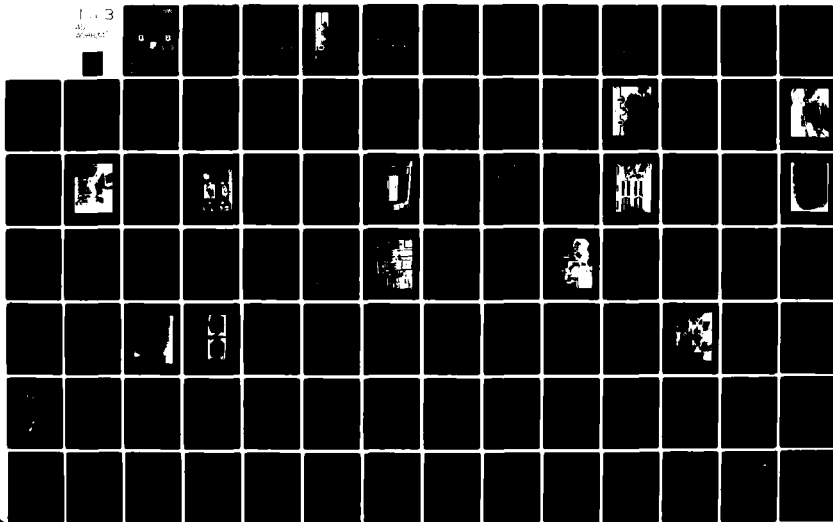
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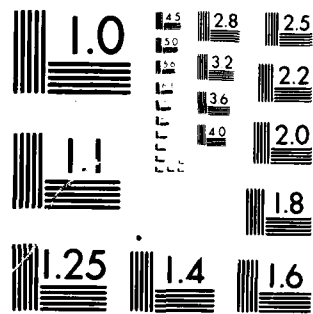
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RADC-TR-80-195, Vol III (of three)
In-House Report
3-4 June 1980

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B.S.

AD A088341

ROME AIR DEVELOPMENT CENTER
(RADC)

INDUSTRY LOOKS AT RADC - 1980



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ROME AIR DEVELOPMENT CENTER
Air Force Systems Command
Griffiss Air Force Base, New York 13441

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Because of the size of this document, it has been divided into three volumes. Volume I contains pages 1 - 303, Volume II contains pages 305 - 541, and Volume III contains pages 543 - 791.

RADC-TR-80-195, Volume III (of three) has been reviewed and is approved for publication.

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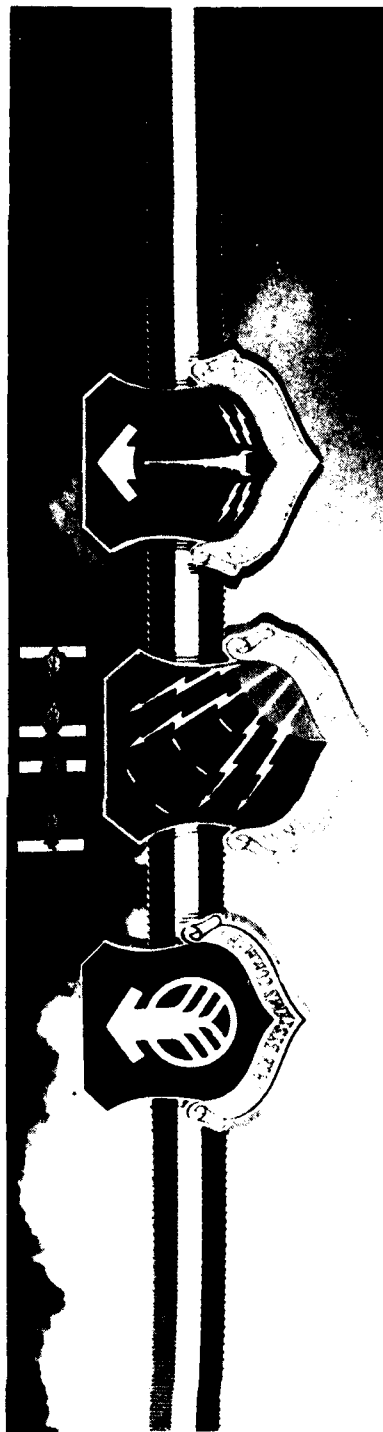
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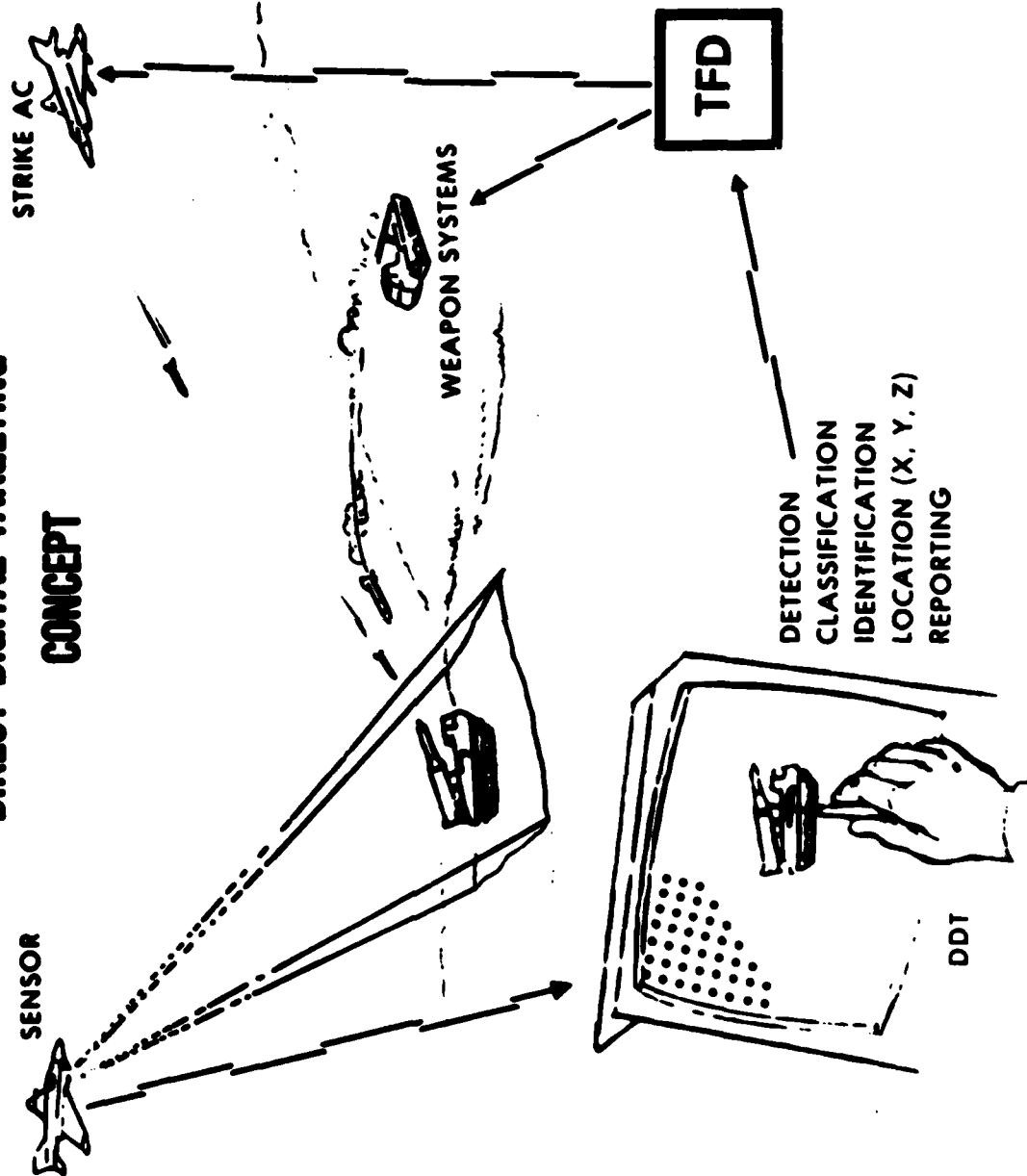
DIRECT DIGITAL TARGETING

PRESENTED BY: MAJ. A. C. CRANE, JR.

RADC/IRR

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DIRECT DIGITAL TARGETING CONCEPT



DIRECT DIGITAL TARGETING

PROGRAM GOALS: DEVELOP AND DEMONSTRATE A CAPABILITY TO PERFORM AUTO AND SEMI-AUTO
TARGET CUEING, DETECTION, IDENTIFICATION, PRECISE LOCATION AND
REPORTING FROM NEAR-REAL-TIME DIGITAL IMAGERY SENSORS.

TECHNICAL AREAS: - DIGITAL IMAGE EXPLOITATION
 - MASS STORAGE AND RETRIEVAL
 - PRECISE TARGET LOCATION

PROGRAMS:

6.2
6.3

FUNDING FY81 - FY86
(IN MILLIONS)

\$ 4.43
\$19.85

TECH BASE FOR DIRECT DIGITAL TARGETING (DDI)

OBJECTIVE: PULL EXISTING TECH BASE TOGETHER AND FOCUS ON THE CAPABILITY TO ACCOMPLISH NEAR REAL TIME DIGITAL IMAGERY EXPLOITATION IN 5 MIN WITH < 50 FT TARGET LOCATION ACCURACY.

RATIONALE: A USAF CAPABILITY TO PERFORM TARGET DETECTION, IDENTIFICATION, PRECISE LOCATION, AND REPORTING IN A NEAR-REAL-TIME OPERATIONAL SCENARIO DOES NOT EXIST.

PAYOFF:

- TECHNOLOGY TO DETECT, ID, LOCATE, REPORT ON TARGETS IN NRT IN ALL WEATHER.
- PROVIDE TECHNOLOGY FOR A COMMON SYSTEM, (I.E., NOT SENSOR/MISSION UNIQUE GROUND EXPLOITATION SYSTEMS) TO SUPPORT TACTICAL AND STRATEGIC FORCES.

TECH BASE FOR DIRECT DIGITAL TARGETING

TECHNICAL APPROACH:

INTEGRATE DEVELOPMENTS IN

- PATTERN RECOGNITION
- TARGET DETECTION/IDENTIFICATION
- MASS STORAGE & RETRIEVAL
- PRECISE TARGET LOCATION
- NRT REPORTING
- C³I INTERFACE

LABS/FIELD DEMONSTRATION

- MODULAR
- USER INTERACTION
- EXPLOITATION OF ALL DIGITAL IMAGERY SENSORS

ALTERNATIVES

- CONTINUE WITH CURRENT SYSTEM TO DEVELOP UNIQUE END ITEMS
- SURVIVABILITY (REDUNDANCY), MAINTENANCES, TRAINING PROBLEMS.

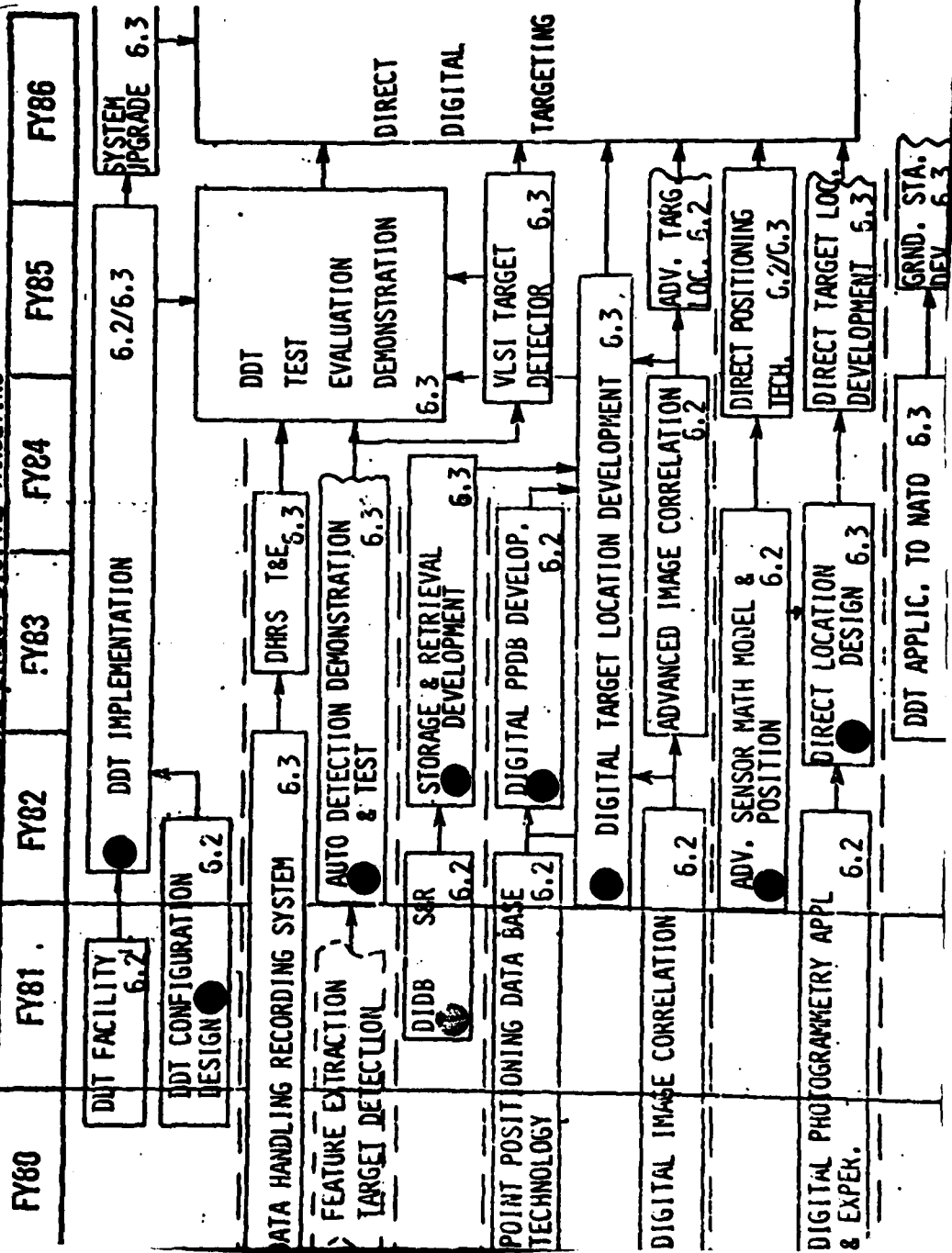
WHY DDT

- THE COMMON SYSTEM APPROACH PROVIDES A MORE COST EFFECTIVE, RESPONSIVE AND SUPPORTABLE OPERATIONAL CAPABILITY.

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THRUST:

~~C4C TACTICAL C³/INTELLIGENCE/DIRECT DIGITAL TARGETING~~



DIRECT DIGITAL TARGETING

BLOCK TITLE: DDT IMPLEMENTATION

OBJECTIVE: PROVIDE SUITABLE ENVIRONMENT AND FUNCTIONAL ARCHITECTURE TO PERMIT DEVELOPMENT AND DEMONSTRATION OF DDT AND C³ NODE INTERFACES AND INTEROPERABILITY.

TECHNICAL APPROACH:

- EMPLOY MODULAR APPROACH
- START WITH AVAILABLE DIGITAL TECHNOLOGY
- INCORPORATE TECHNICAL IMPROVEMENTS
- PERFORM FUNCTIONAL TESTS USING ALL SOURCE IMAGE INPUTS

PAYOFF: HIGH

DIRECT DIGITAL TARGETING

BLOCK TITLE: DDT CONFIGURATION DESIGN

OBJECTIVE: DEFINE DDT FLOW PROCESSES AND FUNCTIONS; DEVELOP A CONFIGURATION CONCEPT TO PERMIT DEMONSTRATION. SIMULATION AND/OR EVALUATION OF THE USE OF NRT DIGITAL IMAGE DATA FROM THE SOURCE TO THE BATTLE COMMANDER.

TECHNICAL APPROACH:

- PERFORM SCENARIO ANALYSES - NATIONAL AND TACTICAL SENSORS
- DEVELOP OVERALL PROCESS FLOWS
- TIMING OF OPERATIONS ANALYSIS
- ESTABLISH DEVELOPMENT NEEDS

PAYOFF: HIGH - WILL PERMIT ESTABLISHMENT OF WORK FUNCTIONS REFLECTING BEST ANALYSES OF USER REQUIREMENTS.

DIRECT DIGITAL TARGETING

BLOCK TITLE: AUTOMATIC DETECTION DEMONSTRATION AND TEST

OBJECTIVE: DEVELOP AND TEST TECHNIQUES AND EQUIPMENT TO ALLOW REAL TIME
TARGET DETECTION WITHIN MINUTES OF OVERFLIGHT, FROM ALL SOURCE
DIGITAL IMAGE DATA.

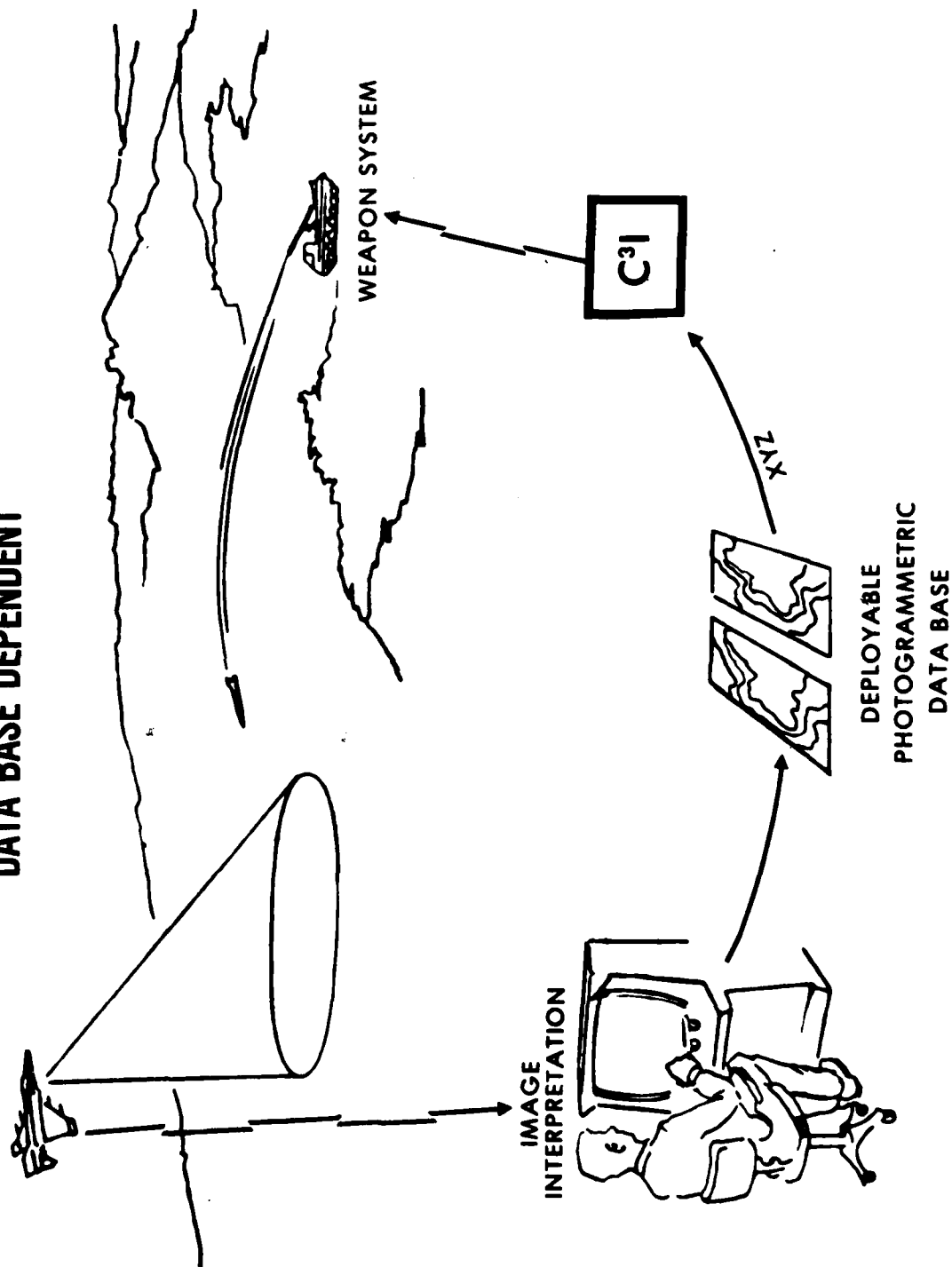
TECHNICAL APPROACH:

- DEVELOP AUTOMATIC TARGET DETECTION ALGORITHMS
- DEVELOP MANAGEMENT TECHNIQUES
- TEST AND IMPLEMENT
- FABRICATE CONSOLE - DEMONSTRATE R-T TARGET DETECTION
- WORK IN DYNAMIC ENVIRONMENT - MULTIPLE SOURCE INPUTS

PAYOFF:

- SENSOR INDEPENDENT R-T EXPLOITATION
- SUPPORT MOBILE TARGET STRIKES

DATA BASE DEPENDENT



DIRECT DIGITAL TARGETING

BLOCK TITLE: DIGITAL IMAGE DATA BASE STORAGE AND RETRIEVAL (DIDB S&R)

OBJECTIVE:

- ESTABLISH S&R DEVICE DESIGN SPECS
- DEVELOP S&R ALGORITHMS

TECHNICAL APPROACH:

- DETERMINE AND EVALUATE DATA FLOWS
- TRADE-OFF ANALYSES
- SELECT OPTIMUM PARAMETERS
- INCLUDE OPTICAL DISK AND HIGH DENSITY MAGNETIC TAPE

PAY OFF: HIGH - EFFORT WILL LOWER RISK OF S&R DEVICE DEVELOPMENT

DIRECT DIGITAL TARGETING

BLOCK TITLE: STORAGE AND RETRIEVAL DEVELOPMENT

OBJECTIVE: PROVIDE A MASS STORAGE AND RETRIEVAL MEDIUM TO ACCOMMODATE
A DIGITAL IMAGE DATA BASE FOR THE TARGET LOCATION FUNCTION.

TECHNICAL APPROACH: PERFORM DETAIL DESIGN, FABRICATE AND INTEGRATE INTO THE
DDT SYSTEM.

PAY OFF: HIGH. DDT OBJECTIVES DEPEND UPON THE AVAILABILITY OF HIGH
DENSITY RAPID AND RANDOM ACCESS, RELIABLE DATA STORAGE AND
RETRIEVAL MECHANISMS.

DIRECT DIGITAL TARGETING

BLOCK TITLE: DIGITAL POINT POSITIONING DATA BASE (PPDB) DEVELOPMENT

OBJECTIVE:

DEVELOP AN EXPERIMENTAL ALL DIGITAL POINT POSITIONING DATA
BASE TO PROVIDE NRT PRECISE TARGET LOCATIONS FROM MULTI SENSOR
RECCE IMAGERY.

TECHNICAL APPROACH:

- CONVERT WORKING SEGMENTS OF AVAILABLE HARDCOPY IMAGERY
- DEFINE DIGITAL FORMAT AND GENERATE DIGITAL PPDB
- STORE ON MASS STORAGE DEVICE
- RETRIEVE AND EXPLOIT - PERFORM EXPERIMENTS
- GENERATE SPECS FOR OPERATIONAL DIGITAL PPDB

PAYOFF:

- RAPID TARGET LOCATION OPERATIONS
- EXPERIMENTALLY ESTABLISHED DIGITAL PPDB REQUIREMENTS
- CONFIDENCE IN DESIGN PARAMETERS

DIRECT DIGITAL TARGETING

BLOCK TITLE: DIGITAL TARGET LOCATION DEVELOPMENT

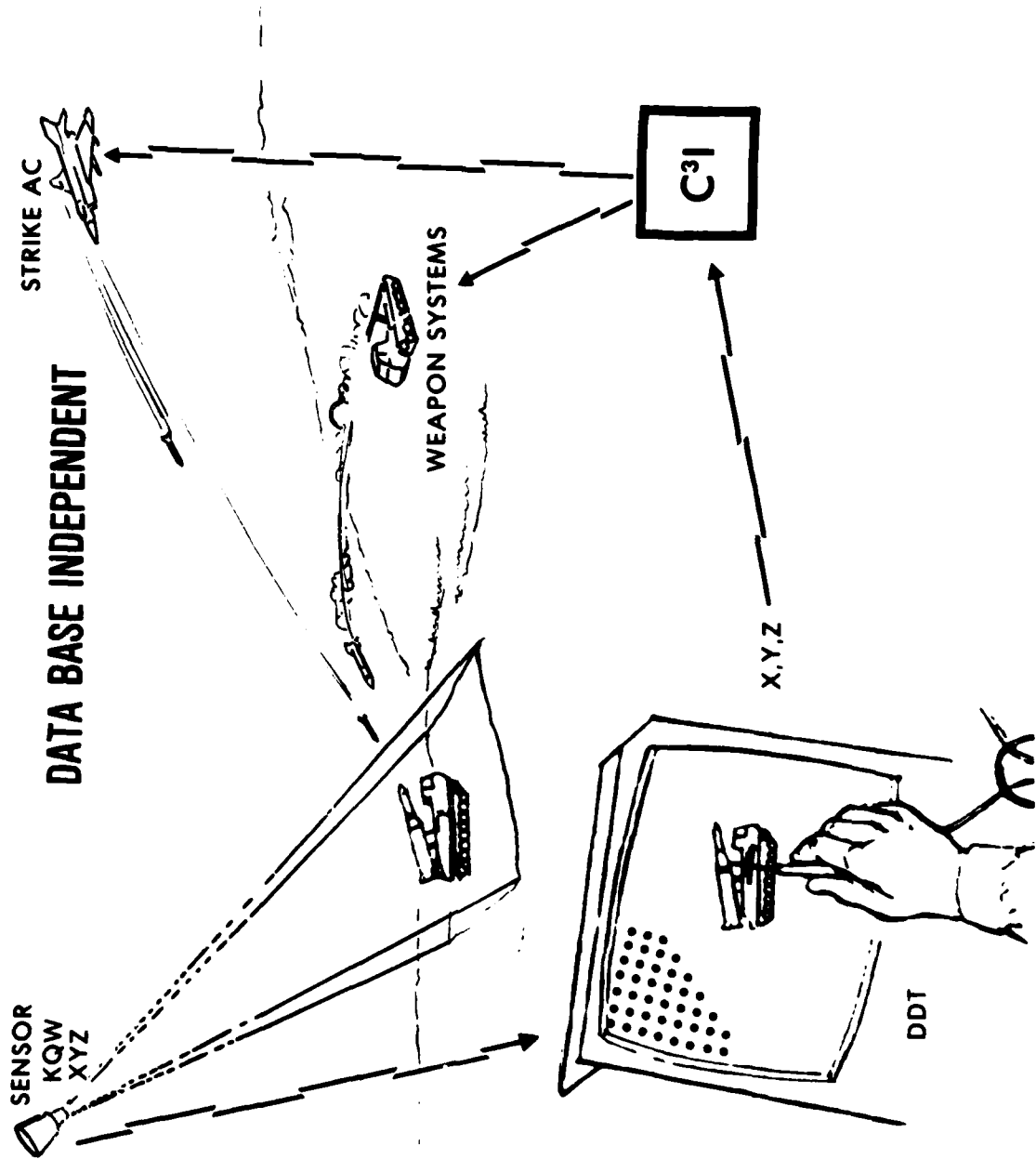
OBJECTIVE:

TO PROVIDE THE DESIGN, FABRICATION, AND TEST AND EVALUATION
IN THE DDT ENVIRONMENT OF A CAPABILITY TO DERIVE PRECISE
TARGET LOCATION INFORMATION IN NEAR-REAL-TIME.

TECHNICAL APPROACH:

- EMPLOY MODULAR APPROACH
- PERFORM SYSTEM DESIGN THAT INCLUDES DIGITAL IMAGE VIEWING,
MEASUREMENT, POINT TRANSFER, PPDB STORAGE & RETRIEVAL
- FABRICATION OF SYSTEM
- TEST AND DEMONSTRATION
- HIGH. PROVIDES NRT PRECISE TARGET LOCATION CAPABILITY

PAY OFF:



DIRECT DIGITAL TARGETING

BLOCK TITLE: ADVANCED SENSOR MATH MODEL AND POSITION

OBJECTIVE:

IN CONJUNCTION WITH THE APPROPRIATE PROGRAM OFFICES DETERMINE THE AVAILABILITY, USABILITY, ACCURACY OF SENSOR ATTITUDE AND POSITION INFORMATION OF ADVANCED DATA LINKED IMAGING SYSTEMS IN REAL-TIME.

TECHNICAL APPROACH:

- DEVELOP ADVANCED IMAGING SENSORS GEOMETRIC MATH MODEL(S)
- PERFORM ERROR PROPAGATION ANALYSIS - ESTABLISH POINT POSITION ACCURACIES
- PERFORM SCENARIO ANALYSES WITH SENSOR POSITION AND ATTITUDE DATA

PAY OFF:

HIGH

DIRECT DIGITAL TARGETING

BLOCK TITLE: DIRECT LOCATION DESIGN

OBJECTIVE:

TO DESIGN A POINT POSITIONING DATA BASE INDEPENDENT
TARGET LOCATION CAPABILITY.

TECHNICAL APPROACH:

- BUILD ON ADV. SENSOR MATH MODEL AND POSITION STUDY
- BUILD ON DIGITAL SOFT COPY MENSURATION AND ANALYTICAL STUDIES
- DEVELOP DESIGN TO INTEGRATE TECHNOLOGIES
- DEVELOP SPECIFICATION FOR DIRECT TARGET LOCATION SYSTEM

PAY OFF:

- HIGH. WILL PROVIDE DIRECT TARGET LOCATION DESIGN PARAMETERS
- WILL REDUCE RISK OF FOLLOW-ON DEVELOPMENT

DIRECT DIGITAL TARGETING

BLOCK IIILE: DDT APPLICATIONS TO NATO

OBJECTIVE: TO PROVIDE NATO RELEASABLE TECHNOLOGY TO SATISFY THE REQUIREMENTS OF NAFAG SUBGROUP 6 IMAGERY INTELLIGENCE INITIATIVE TO DEVELOP A COMMON GROUND STATION TO SUPPORT NATO IMAGERY RECONNAISSANCE EXPLOITATION, TARGET LOCATION AND REPORTING.

TECHNICAL APPROACH:

A LOW COST, MODULAR APPROACH THAT UTILIZES AVAILABLE DIGITAL TECHNOLOGY WILL BE UTILIZED. HARDWARE AND SOFTWARE TECHNOLOGY IMPROVEMENTS WILL BE INCORPORATED AS THEY BECOME AVAILABLE.

PAY OFF:

PROVIDE NATO WITH A COMMON TECHNOLOGY TO BE INCORPORATED INTO THE DESIGN AND PRODUCTION OF IMAGERY RECONNAISSANCE GROUND STATION. THIS WILL ASSURE SURVIVABILITY THROUGH FLEXIBILITY AND REDUNDANT CAPABILITIES IN TIME OF WAR.

DIRECT DIGITAL TARGETING
KEY PEOPLE

PROGRAM MANAGER - MAJOR ALFRED C. CRANE, JR./IRRA/X7024

DDT IMPLEMENTATION - MR. KEITH A. BUTTERS/IRRA/X6270
& CONFIGURATION DESIGN - MR. DONALD MOE/IRRA/X2476

AUTOMATIC DETECTION - MR. DONALD BUSH/IRRE/X3095
DEMONSTRATION & TEST

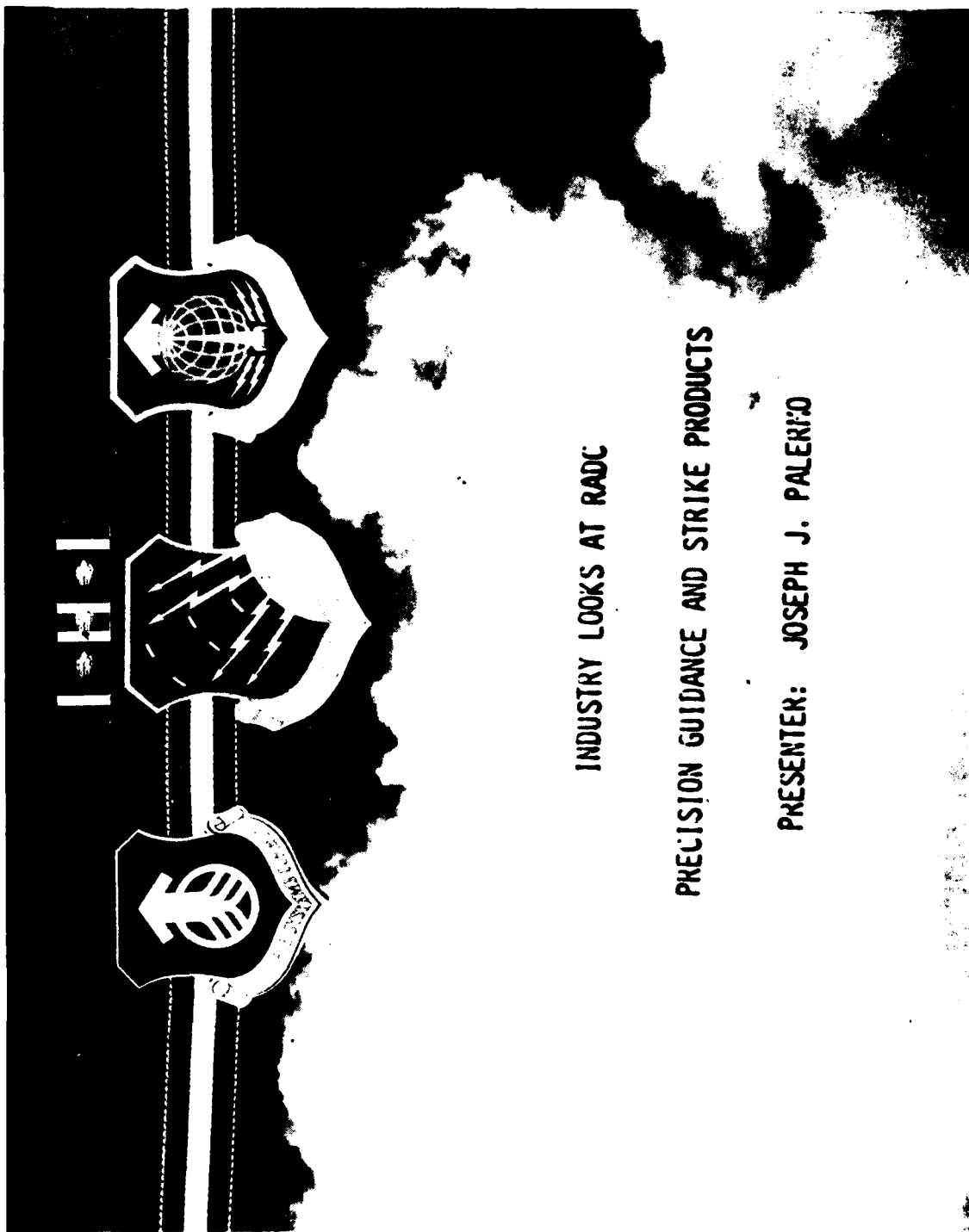
DIGITAL IMAGE DATA - MR. DONALD HALL/IRRA/X2476
BASE STORAGE & RETRIEVAL

STORAGE & RETRIEVAL - MR. ALBERT JAMBERDINO/IRAP/X4581
DEVELOPMENT

DIGITAL POINT POSITIONING - MR. DONALD HALL/IRRA/X2476
DATA BASE (PPDB) DEVELOPMENT/
DIGITAL TARGET LOCATION DEVELOPMENT

ADVANCED SENSOR MATH MODEL & POSITION - MR. DONALD MOE/IRRA/X2476

DDT APPLICATIONS TO NATO - MAJOR ALFRED C. CRANE, JR./IRRA/ 7024



INDUSTRY LOOKS AT RADG

PRECISION GUIDANCE AND STRIKE PRODUCTS

PRESENTER: JOSEPH J. PALERIO

TITLE: PRECISION GUIDANCE AND STRIKE PRODUCTS

PROGRAM GOALS: DEVELOP AUTOMATED CAPABILITY TO PROCESS, STORE, MAINTAIN AND FORMAT EARTH SURFACE DATA (TERRAIN, CULTURE, HYDROGRAPHY, POLITICAL, ETC.) IN SUPPORT OF WEAPON SYSTEM REQUIREMENTS FOR PLANNING, NAV/GUIDANCE, SENSOR SIMULATION/PREDICTION AND TARGETING.

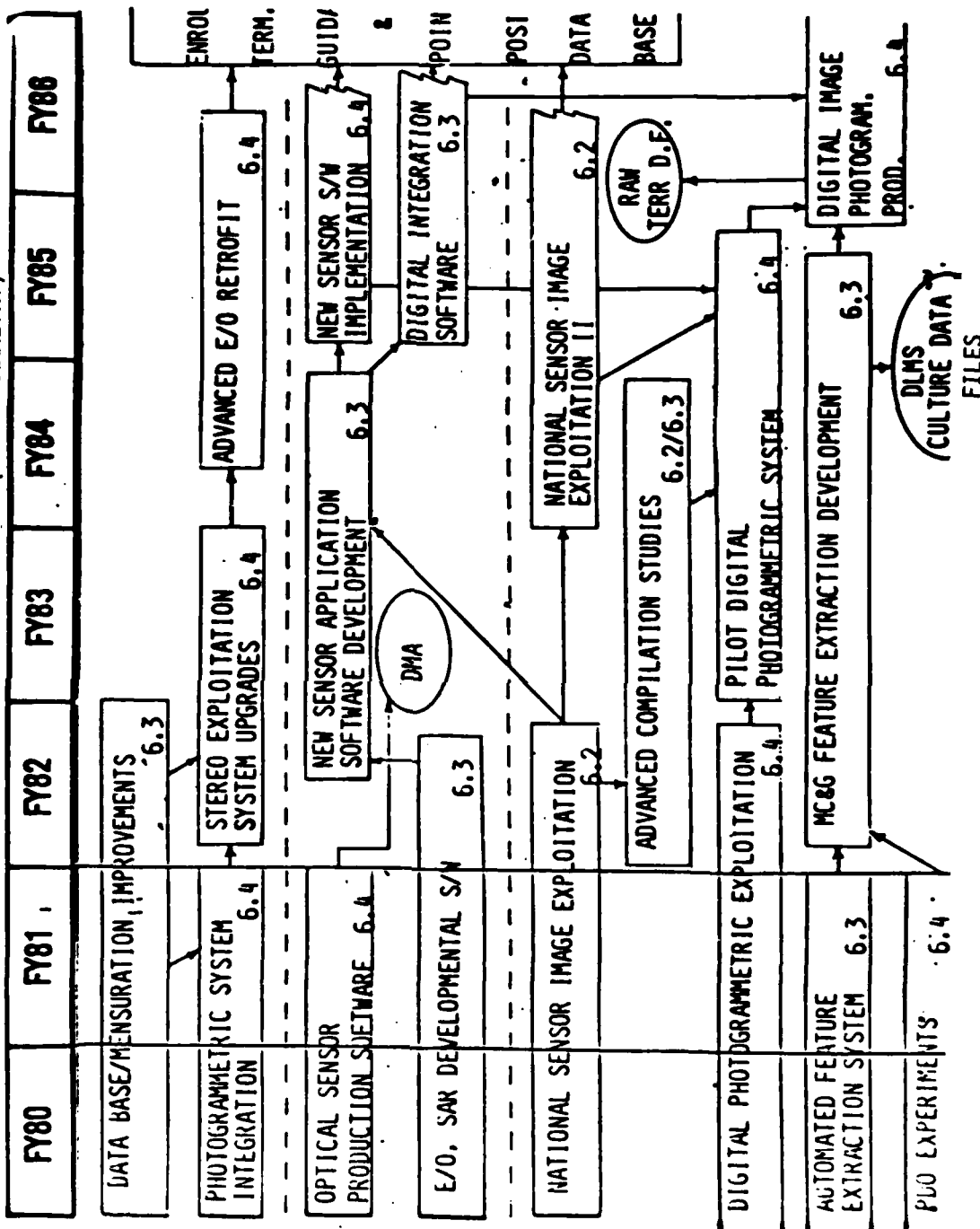
TECHNICAL AREAS:

- PHOTOGRAPHIC EXPLOITATION
- CARTOGRAPHIC EXPLOITATION
- SENSOR SCENE SYNTHESIS
- CARTO PROCESSING/DATA BASE/ARCHITECTURE

FUNDING (APPROXIMATE): FY81 THROUGH FY86

C.2	\$12.500K
E.3	\$31.500K
E.4	\$26.000K

PRECISION GUIDANCE AND STRIKE PRODUCTS (PHOTOGRAMMETRY)





**PRECISION GUIDANCE AND STRIKE PRODUCTS
(PHOTOGRAPHY)**

AREA TITLE: HARD COPY PHOTOGRAPHY

**OBJECTIVE: IMPROVEMENT OF IN-PLACE DIA PRODUCTION SYSTEMS VIA ENHANCEMENT
OF MEASUREMENT AND PROCESSING ACCURACIES AND INCORPORATION
OF ADDITIONAL SENSOR FORMATS.**

**EFFORTS: FY81 TA3 PJ RETROFITS
FY82 ALE IMPROVEMENTS**

POI: RADC/IRMA/F. SCARANO 315-330-4203



**PRECISION GUIDANCE AND STRIKE PRODUCTS
(PHOTOGRAMMETRY)**

AREA TITLE: ANALYTICAL SOFTWARE

OBJECTIVE: PROVIDE PROCESSING TO SUPPORT THE INTEGRATION OF PHOTOGRAMMETRIC EQUIPMENT INTO A MORE EFFICIENT PRODUCTION POSTURE. DEVELOP ANALYTICAL MODELS TO INCORPORATE ADDITIONAL SENSORS INTO THE PRODUCTION PROCESS.

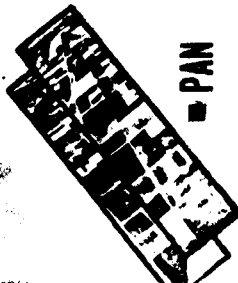
EFFORTS: FY81 POTS OPTIMIZATION
SAR COMPILATION

FY82 DISCONTINUOUS SURFACE FUNCTION ANALYSIS

POC: RADG/IKRA/F. SCARANO 315-330-4203

CONVERSION - STEREOMAPPING

SOURCE



PAN



FRAME

SENSOR PARAMETERS

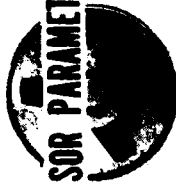
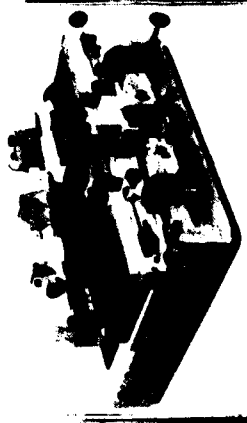


PHOTO DATA BASE

STEREO DIGITIZING



AS-11BX



STEREO COMPILER

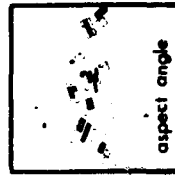
PRODUCTS

DIGITAL TERRAIN FILES

PROFILES

ELEVATION ARRAYS

RADAR CODE



aspect angle

PROFILES



CULTURE FEATURES



CONTOURS



BLACK TONE BACKGROUND SECTION

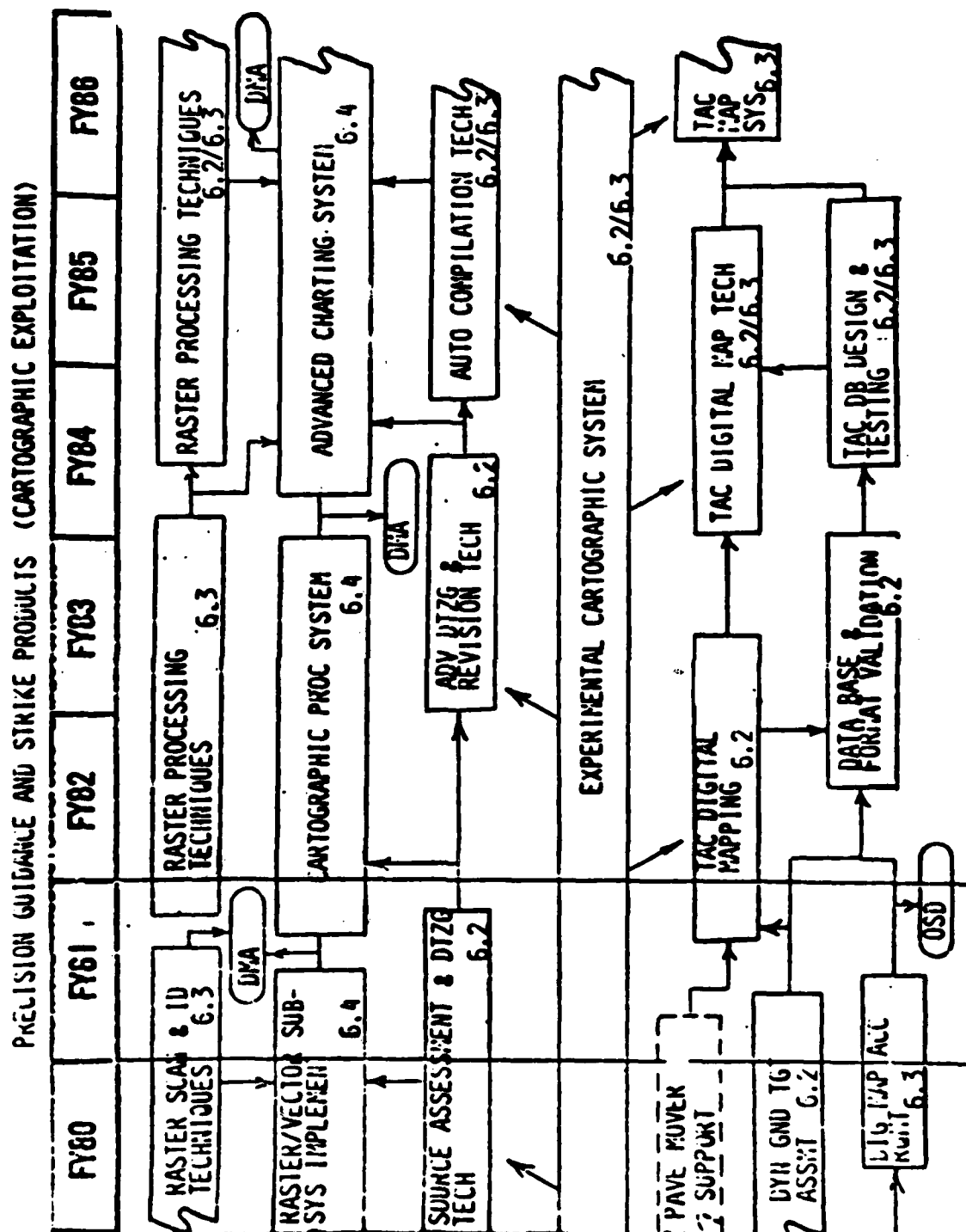
**PRECISION GUIDANCE AND STRIKE PRODUCTS
(PHOTOGRAMMETRY)**

AREA TITLE: SOFTCOPY PHOTOGRAMMETRY

OBJECTIVE: TECH BASE DEVELOPMENT IN DIGITAL STEREO IMAGE EXPLOITATION
METHODS INCLUDING IMAGE VIEWING CONCEPTS, GEOMETRIC DEFINITIONS,
AND IMAGE PATCHING PROCESSES IMPLEMENTATION OF PRODUCTION
SOFTCOPY PHOTOGRAMMETRIC SYSTEMS.

EFFORTS: FY81 POINT INFORMATION MAINTENANCE SYSTEM
UNIVERSAL RECTIFIER DEVELOPMENT.
FY82 PPDB ALTERNATIVE STUDY
AERONAUTICAL PHOTO INTERPRETATION STATION
DIGITAL STEREO COMPARATOR/COMPILER SYSTEM
ADVANCED COMPILATION STUDIES

POC: RADG/IRRA/F. SCARANO 315-330-4203





**PRECISION GUIDANCE AND STRIKE PRODUCTS
(CARTOGRAPHIC EXPLOITATION)**

AREA TITLE: CARTOGRAPHY

OBJECTIVE: PROVIDE SYSTEMS AND TECHNIQUES (HARDWARE AND SOFTWARE)
TO: ASSESS CURRENT PRODUCTS AND SOURCES, DIGITALLY EXTRACT
DATA FROM ANALOG CHART SOURCE, MANIPULATE AND PROCESS
DIGITAL DATA FOR PRODUCT GENERATION AND/OR INCLUSION INTO
THE DIA CARTOGRAPHIC DATA BASE.

EFFORTS: FY81 SCANNING CURSOR
SOURCE ASSESSMENT SYSTEM
RASTER PLOTTER
IN COCKPIT DISPLAY ANALYSIS
FY82 AUTO CARTO FEATURE I.D.
RASTER SCAR CHARACTER RECOGNITION
CARTO COMPILATION/REVISION SYSTEM
RASTER AUTOMATED CARTO SYSTEM

POC: RADC/INRP/J. PALERHO 315-330-7090

**PRECISION GUIDANCE AND STRIKE PRODUCTS
(CARTOGRAPHIC EXPLOITATION)**

AREA TITLE: TACTICAL DIGITAL MAPPING

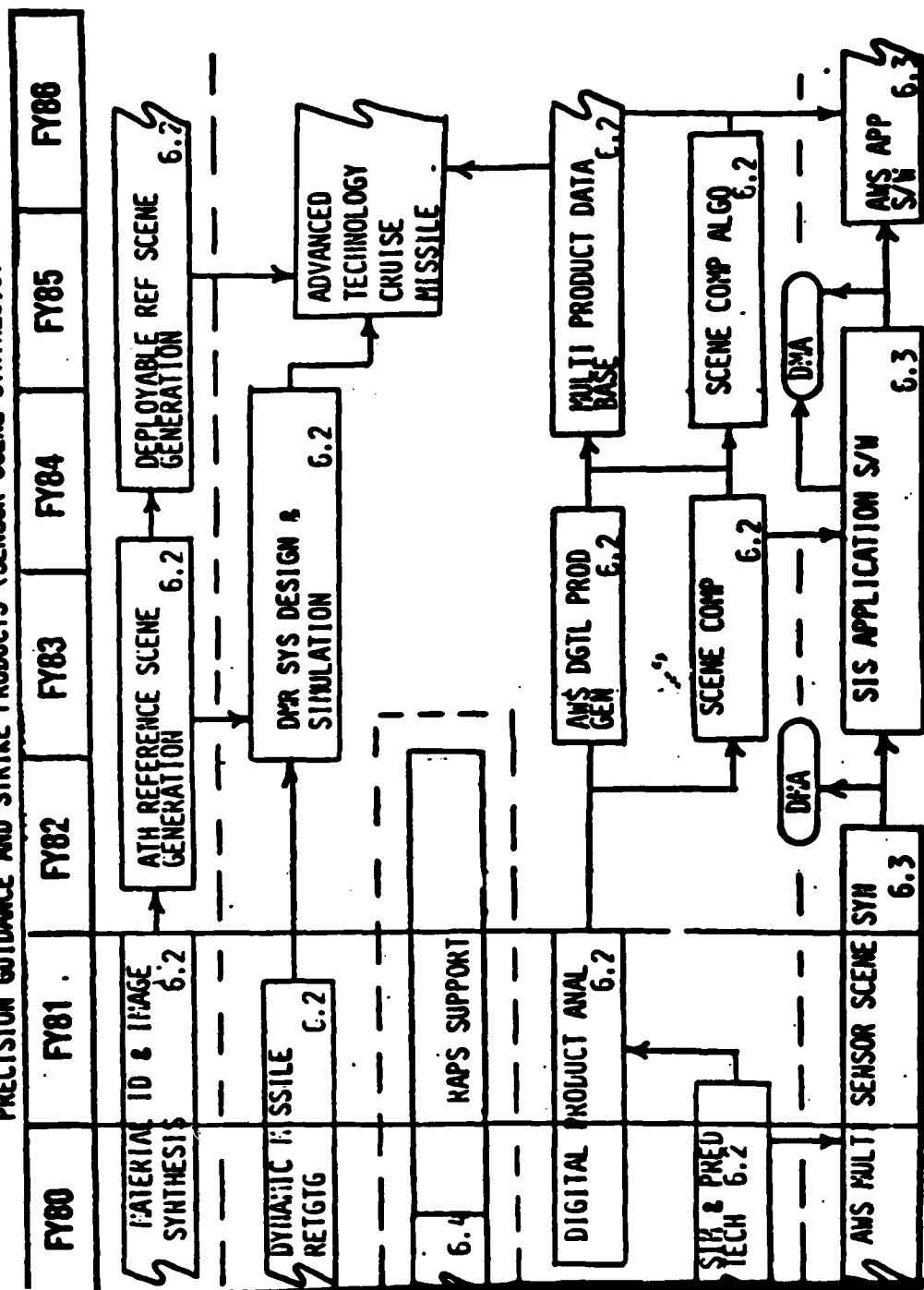
**OBJECTIVE: IDENTIFY TERRAIN ANALYSIS DATA AND APPLICATIONS IN SUPPORT
OF ADVANCED AF TACTICAL SENSOR/STRIKE AND CORRELATION
FUSION ACTIVITIES.**

**DEVELOP METHODS TO DETERMINE EFFECTS OF DATA BASE CHANGES
AND METHODS TO VALIDATE DATA BASE CONTENT AND ACCURACY
FOR ADVANCED WEAPON SYSTEMS.**

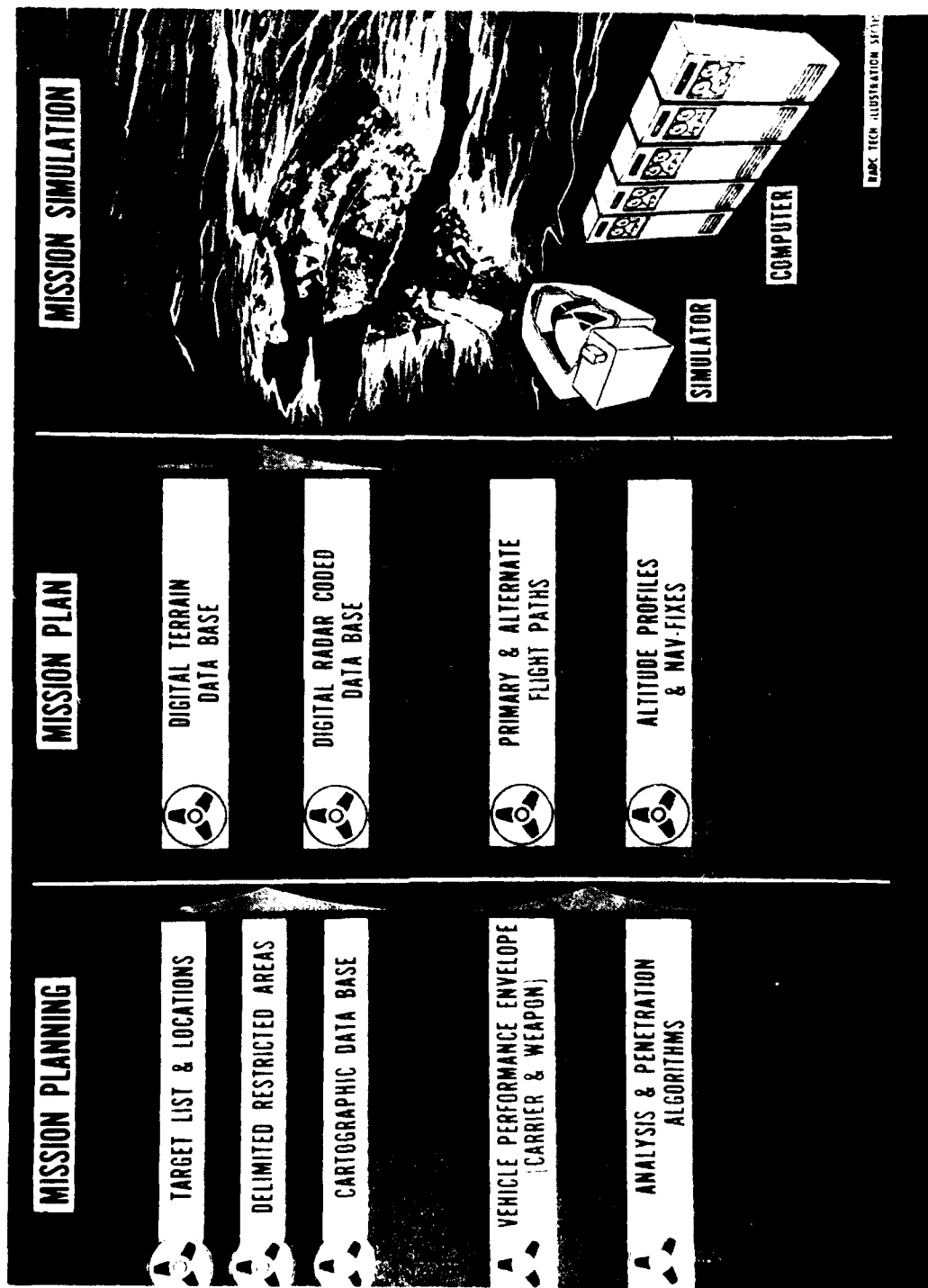
**EFFORTS: FY81 TACTICAL DIGITAL MAPPING
FY82 DATA BASE & FORMAT VALIDATION**

POC: RADC/IRRP/MAJ E. NEEL 315-330-6272

PRECISION GUIDANCE AND STRIKE PRODUCTS (SENSOR SCENE SYNTHESIS)



MISSION PLANNING - SIMULATION



**PRECISION GUIDANCE AND STRIKE PRODUCTS
(SENSOR SCENE SYNTHESIS)**

AREA TITLE: SENSOR IMAGE SIMULATION

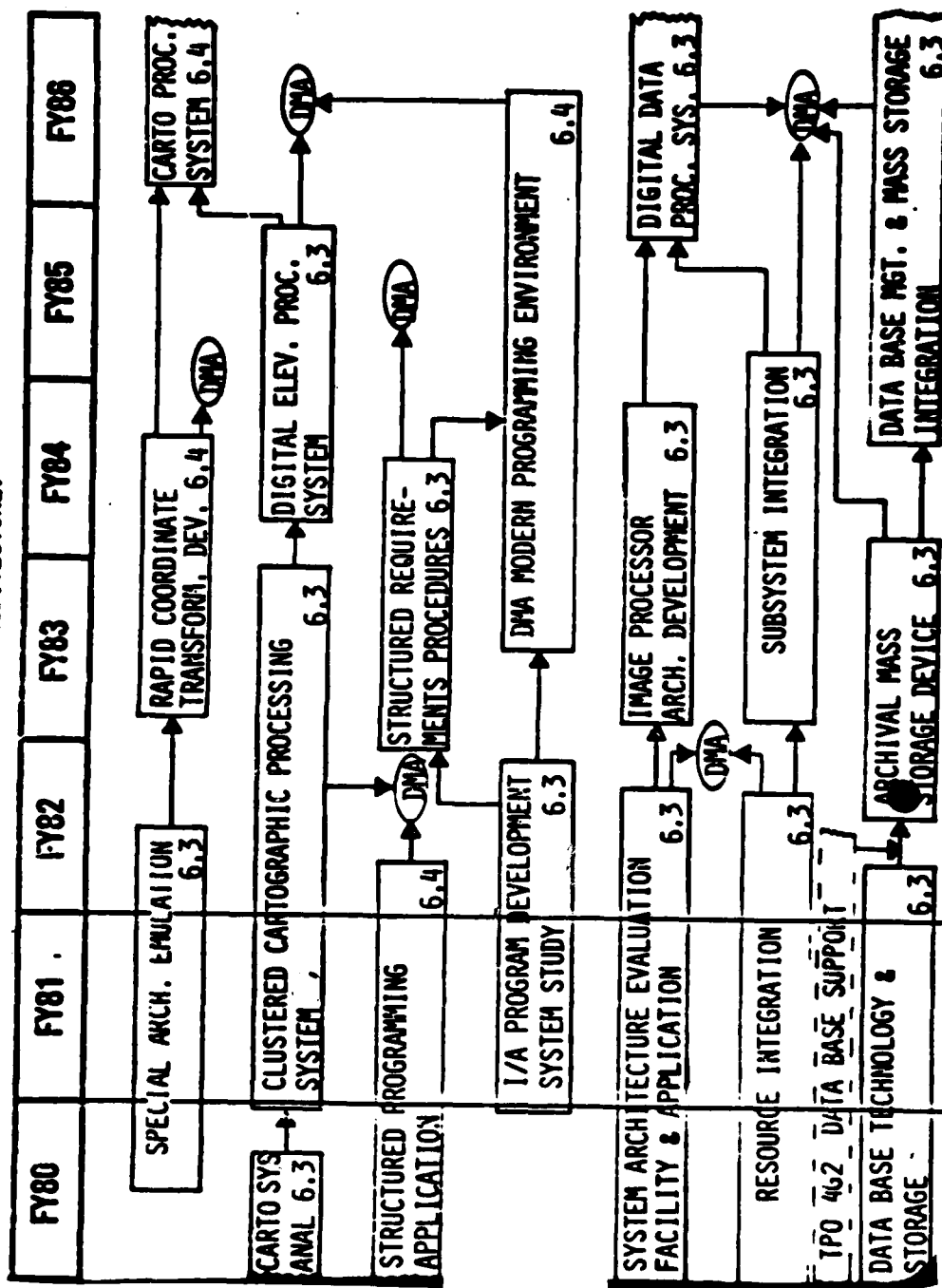
OBJECTIVE: DETERMINATION OF UNIQUE AND TIME VARIANT DESCRIPTORS TO PERMIT THE DFAD DATA BASE TO SUPPORT A WIDE CLASS OF SENSOR SIMULATIONS.

DETERMINE DATA CHARACTERISTICS TO SUPPORT THE 15F12 NAV TRAINER (RADAR) AND VISUAL SIMULATION REQUIREMENTS.

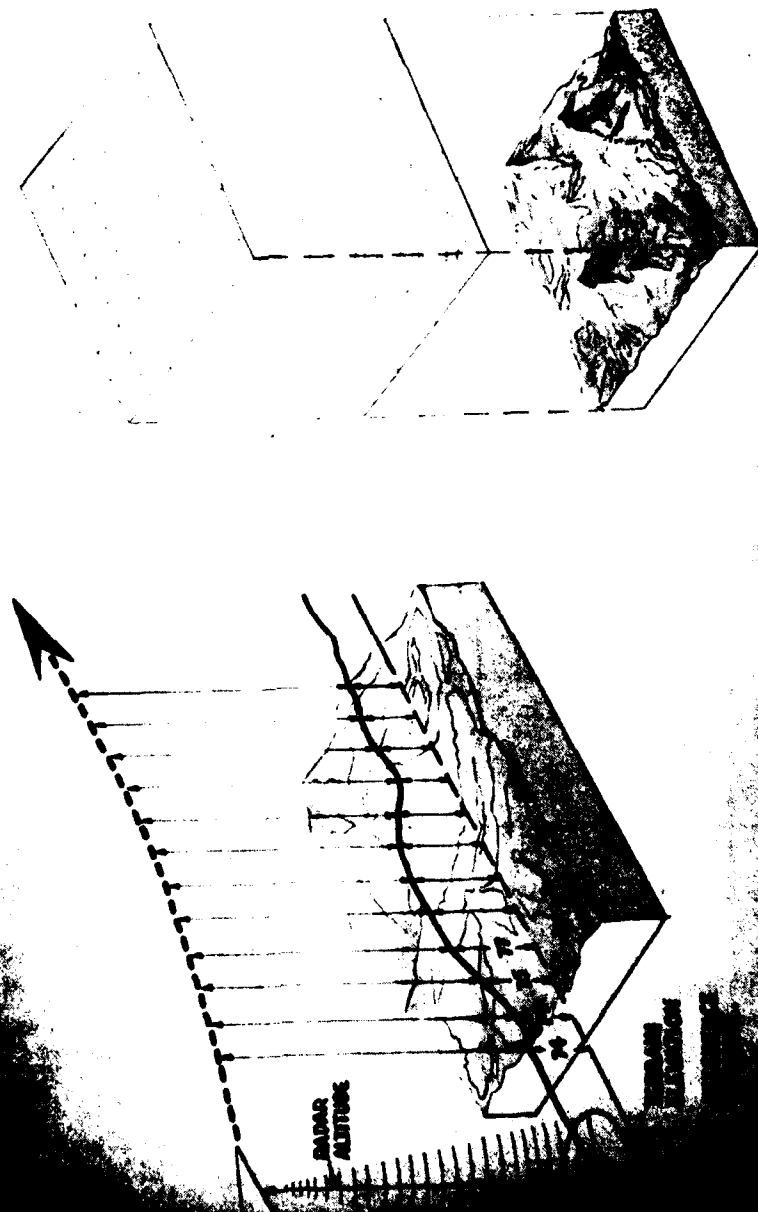
EFFECT: FY81 ADVANCED WEAPONS SIMULATION (TASK A)
ADVANCED WEAPONS SIMULATION (TASK B)

DOC: RADC/IRRP/R. HOFFMANN 315-330-2217

PRECISION GUIDANCE AND STRIKE PRODUCTS
(CARTO PROCESS/DATA BASE/ARCHITECTURE)



Navigation Concept



**PRECISION GUIDANCE AND STRIKE PRODUCTS
(CARTO PROCESS/DATA BASE/ARCHITECTURE)**

AREA TITLE: CARTO PROCESSING SYSTEM

**OBJECTIVE: PROVIDE TECHNIQUE DEVELOPMENT AND PRODUCTION IMPLEMENTATION
TO ALLEVIATE DIA DIGITAL DATA PRODUCTION PROCESS PROBLEMS.
PROVIDE ON-LINE CENTRALIZED CONTROL AND POST-PROCESSING
FOR EXISTING AND PLANNED DIAAC DIGITAL CARTOGRAPHIC PRODUCTION
SYSTEMS.**

EFFORTS: FY81 DIGITAL ELEVATION MATRIX PROCESSING

POC: RADG/ISCA/O. REHMANN 315-330-4728

**PRECISION GUIDANCE AND STRIKE PRODUCTS
(CARTO PROCESS/DATA BASE/ARCHITECTURE)**

AREA TITLE: SYSTEM ARCHITECTURE EVALUATION

**OBJECTIVE: DEVELOP A BASE FOR EXPERIMENTATION WITH COMPUTER ARCHITECTURES
AND PROCESSING CONFIGURATION EVALUATION. EMPLOY TO MODEL
PDOP PROCESSING STRUCTURE TO OBTAIN PROBLEMS.**

EFFORTS: FY81 SYSTEM ARCHITECTURE EVALUATION

POL: RAUC/ISCA/O. REIFMAN 315-330-4728

**PRECISION GUIDANCE AND STRIKE PRODUCTS
(CARTO PROCESS/DATA BASE/ARCHITECTURE)**

AREA TITLE: RESOURCE INTEGRATION

**OBJECTIVE: DETERMINE FEASIBILITY, UTILITY AND COST EFFECTIVENESS
OF DIA INTRA-CENTER RESOURCE SHARING.
DESIGN AND IMPLEMENTATION OF A NETWORK OF EXISTING DIGITAL
IMAGE PROCESSING/AUTOMATED FEATURE EXTRACTION SYSTEMS
AT THE DIA CENTERS.**

**EFFORTS: FY81 DIAHTC P.S.I. ANALYSIS
EXPERIMENTAL INTEGRATION IMPLEMENTATION**

POI: RADC/ISCA/O. REIMANN 315-330-4728

SOLID STATE DEVICE RELIABILITY

JOHN BART
RADC/RB

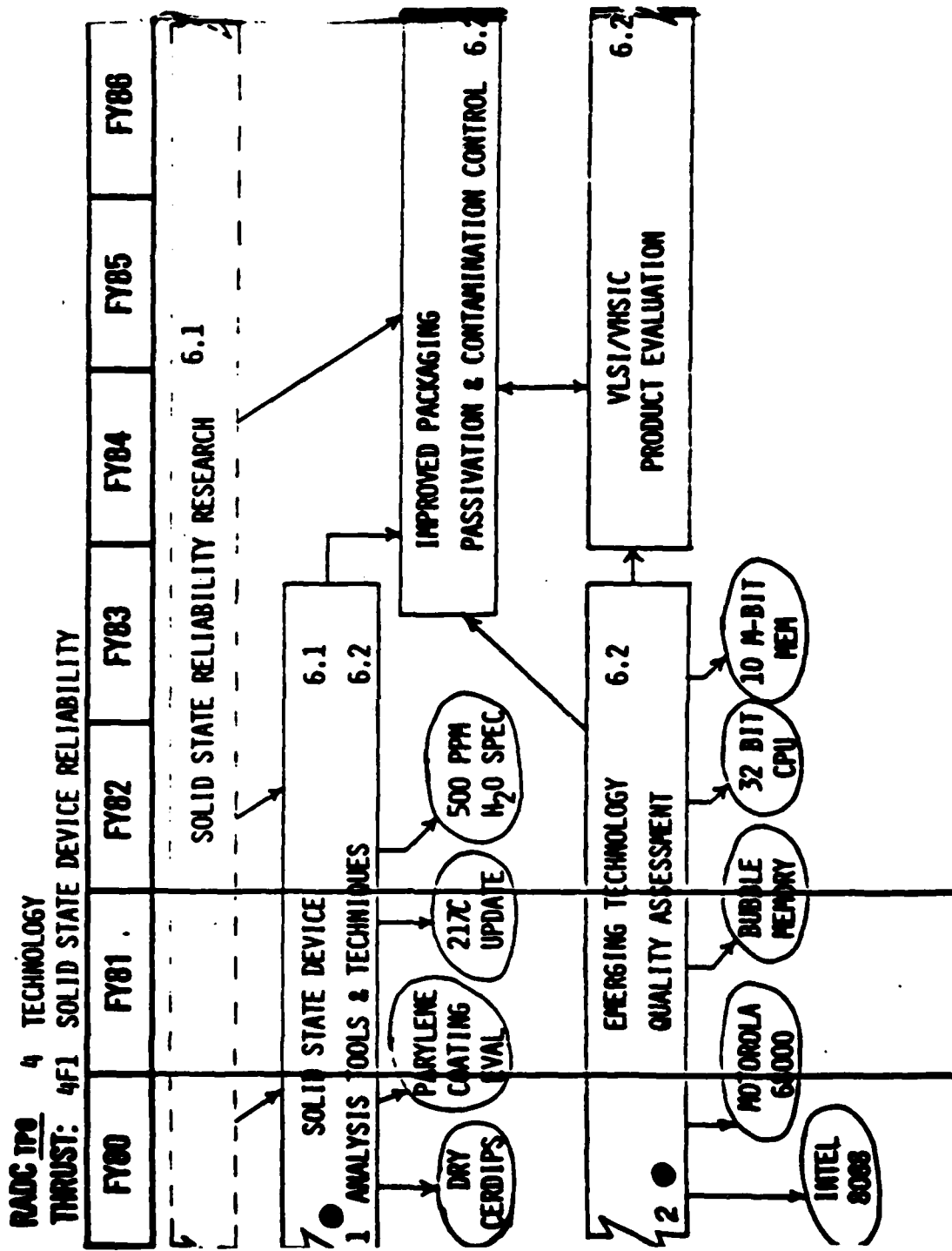
TPO/THRUST: 4E/RELIABILITY, MAINTAINABILITY AND COMPATIBILITY

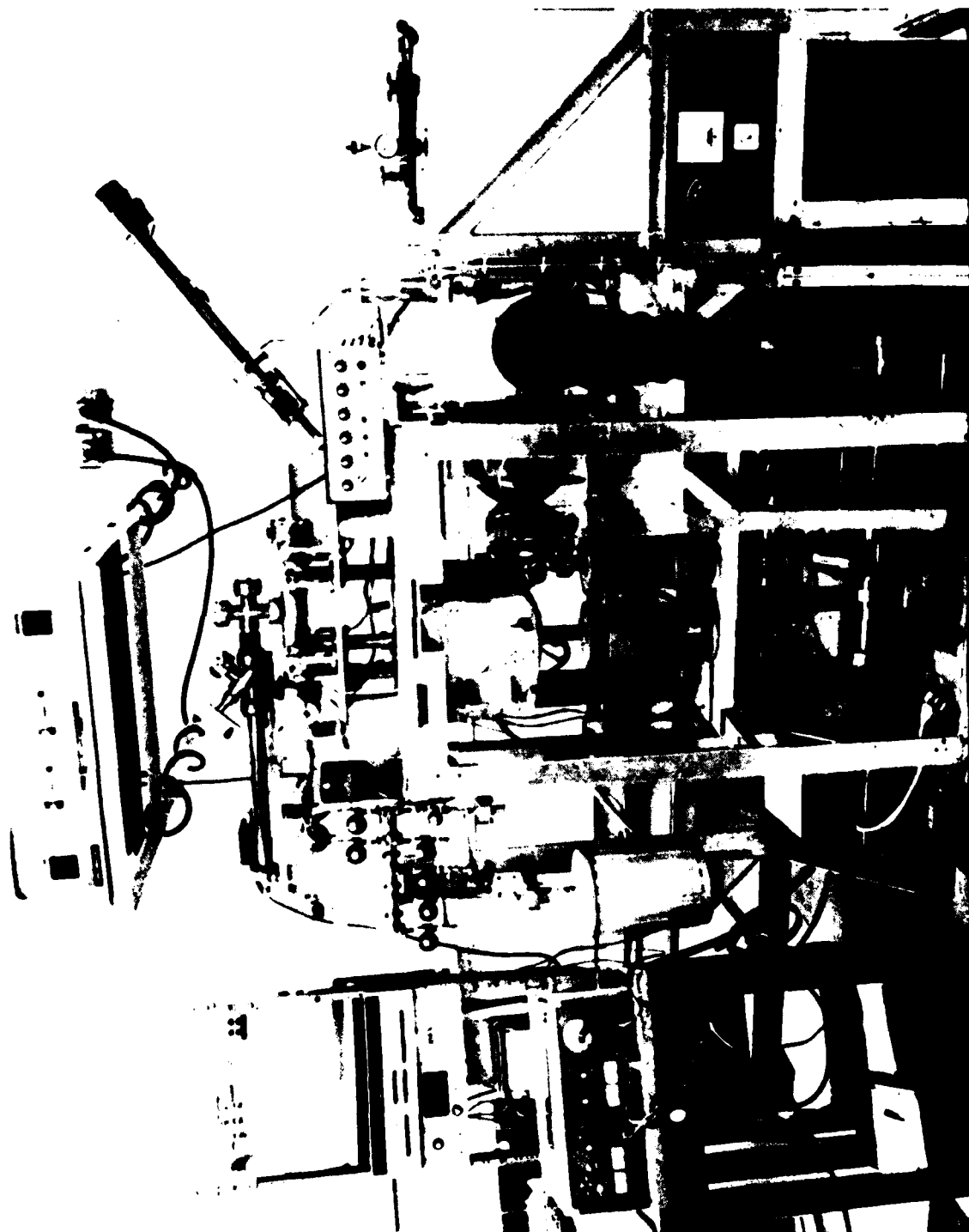
SUB-THRUST: 1/SOLID STATE DEVICE RELIABILITY

PROGRAM GOAL: ASSURE THE AVAILABILITY OF RELIABLE SOLID STATE DEVICES
FOR AIR FORCE AND DOD ELECTRONIC SYSTEMS

TECHNICAL AREAS:

- SOLID STATE DEVICE ANALYSIS TOOLS AND TECHNIQUES
- EMERGING TECHNOLOGY QUALITY ASSESSMENT
- ELECTRICAL CHARACTERIZATION OF SOLID STATE MICROCIRCUITS
- VHSIC TEST TECHNOLOGY
- QUALITY AND RELIABILITY ASSURANCE AND DESIGN CONCEPTS
- RELIABILITY PHYSICS TECHNOLOGY
- ACCELERATED LIFE TESTING AND FAULT DETECTION FOR LSI/VLSI
- RELIABILITY ASSESSMENT OF SOLID STATE MICROCIRCUITS





TPO/THRUST: RE/RELIABILITY, MAINTAINABILITY AND COMPATIBILITY

SUB-THRUST: 1/SOLID STATE DEVICE RELIABILITY

BLOCK TITLE: SOLID STATE DEVICE ANALYSIS TOOLS AND TECHNIQUES 1

OBJECTIVE: DEVELOP AND MAINTAIN LABORATORY TOOLS TO EXAMINE SOLID STATE DEVICES ELECTRICALLY, MECHANICALLY, AND CHEMICALLY AT THE MICROSCOPIC LEVEL

APPROACH:

- INCREASE SENSITIVITY OF LABORATORY INSTRUMENTS OF PROVEN VALUE
(SEM, SCANNING AUGER, MASS SPECTROMETER, ---)
- ADD FEATURES TO INCREASE THROUGHPUT, ACCURACY, AND CAPABILITY
(X-RAY SPECTROMETER, AUTOMATIC SAMPLE CHANGER, INSITU SOFTWARE)
- DEVELOP NEW CAPABILITY
(FLUORESCENCE MICROSCOPE, SUBMICRON AUGER SYSTEM, MICRON PROBE)
- DEVELOP STANDARDS FOR CONTROL/ELIM. OF FOREIGN MATERIAL AND POOR PACKAGING
- RELIABLE, LONG-LIFE SOLID STATE DEVICES THROUGH APPLICATION OF EFFECTIVE PACKAGING QUALITY STANDARDS

PAY OFF:

TPO/THRUST: RE/RELIABILITY, MAINTAINABILITY AND COMPATIBILITY

SUB-THRUST: I/SOLID STATE DEVICE RELIABILITY

BLOCK TITLE: EMERGING TECHNOLOGY QUALITY ASSESSMENT 2

OBJECTIVE: DETERMINE STRENGTHS AND WEAKNESSES IN STATE-OF-THE-ART SOLID STATE
DEVICE TECHNOLOGY

APPROACH:

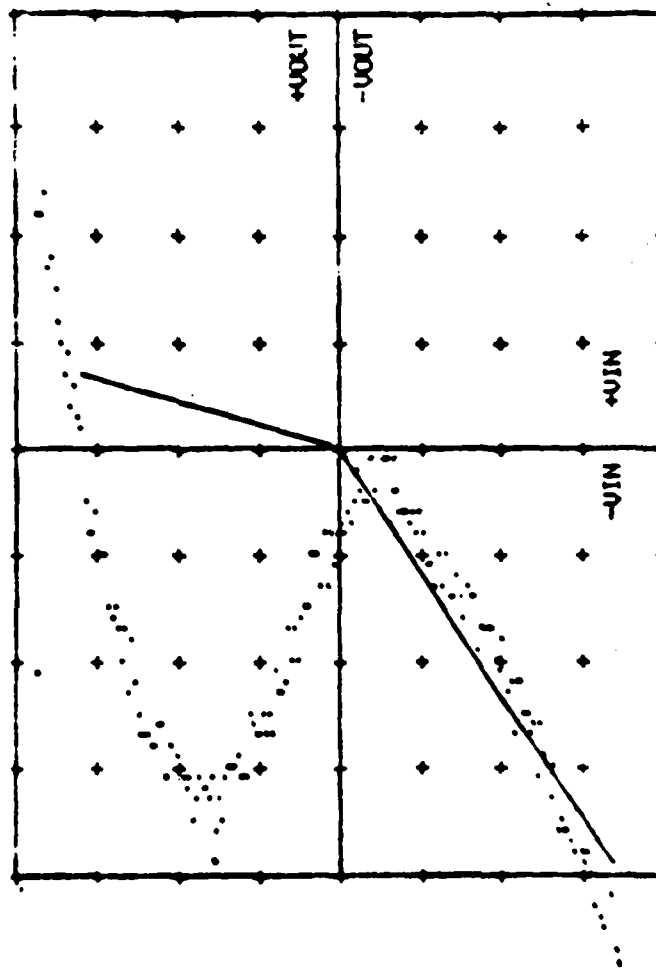
- SELECT STATE-OF-THE-ART LINEAR MICROPROCESSORS, SINGLE CHIP COMPUTERS,
INTELLIGENT PERIPHERAL CHIPS, AND DENSE MEMORIES
- DETERMINE ELECTRICAL DESIGN OF NEW DEVICES
- EVALUATE MECHANICAL STRENGTH AND HERMETIC INTEGRITY OF DEVICES
- DETERMINE CHEMICAL CONTENT OF SOLID STATE DEVICE SURFACE AND PACKAGE AMBIENT
- EVALUATE MILITARY RUGGEDNESS/APPLICABILITY
- EARLY EVALUATION OF NEW DEVICES OF HIGH POTENTIAL TO MILITARY SYSTEMS
- EARLIEST GO/NO GO DATA FOR USAGE IN MILITARY SYSTEMS
- HARD DATA ON THE DIRECTION OF SOLID STATE TECHNOLOGY
- DATA FOR ELECTRICAL CHARACTERIZATION AND RELIABILITY ASSESSMENTS

PAY OFF:

RADC AUTOMATED INTEGRATED CIRCUIT TEST FACILITY



LINE FOOT-MIL STD EQUIVALENT

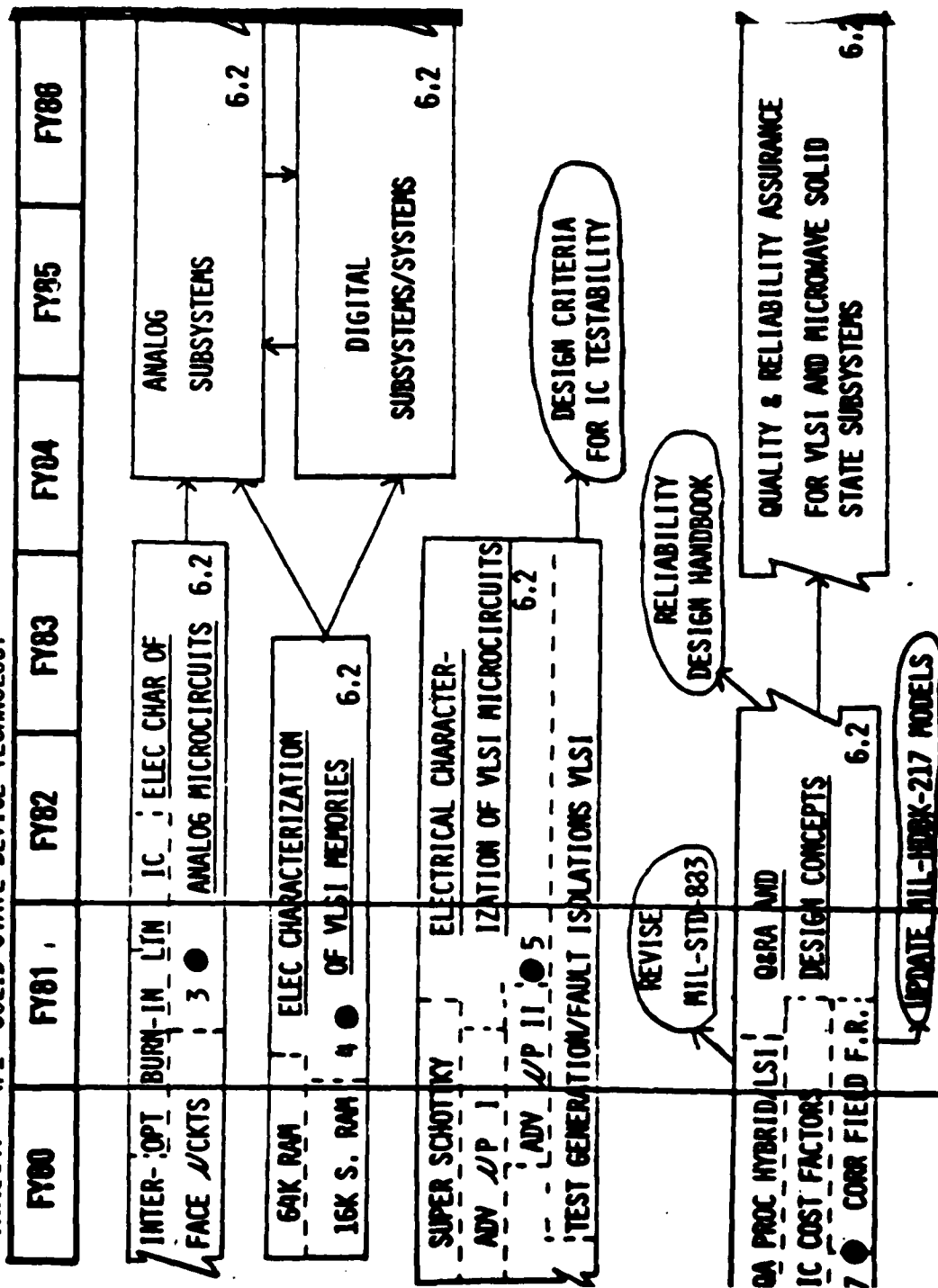


RL= 2 (3 K-0.1)

R A D C OP-AMP REAL TIME TRANSFER FUNCTION ANALYSIS

RADC TPO 4 TECHNOLOGY

THRUST: 4F1 SOLID STATE DEVICE TECHNOLOGY



TPO/THRUST: 4F/RELIABILITY, MAINTAINABILITY AND COMPATIBILITY
SUB-THRUST: 1/SOLID STATE DEVICE RELIABILITY
BLOCK TITLE: ELECTRICAL CHARACTERIZATION OF ANALOG MICROCIRCUITS 3
OBJECTIVE: DETERMINE THE PERFORMANCE, INTERCHANGEABILITY, DESIGN INTEGRITY AND COMPATIBILITY NEEDED TO ASSURE MIL-QUALITY DEVICES

APPROACH:

- USE VENDOR DATA, ELECTRICAL SCHEMATICS AND SUPPLEMENTAL TESTS TO DEVELOP TEST PROCEDURES, TRANSFER FUNCTIONS AND ALGORITHMS
- DETERMINE ALLOWABLE RESPONSES AND LIMITS TO ELECTRICAL, THERMAL AND MECHANICAL STRESSES
- PROVIDE ELECTRICAL PARAMETERS FOR MIL-M-38510 SLASH SHEETS COVERING ANALOG MICROPROCESSOR, DATA ACQUISITION AND INTERFACE MICROCIRCUITS
- RELIABLE ANALOG ICs FOR THE MILITARY ENVIRONMENT

PAY OFF:

TPO/THRUST: 4F/RELIABILITY, MAINTAINABILITY AND COMPATIBILITY

SUB-THRUST: 1/SOLID STATE DEVICE RELIABILITY

BLOCK TITLE: ELECTRICAL CHARACTERIZATION OF VLSI MEMORIES 4

OBJECTIVE: DETERMINE THE PERFORMANCE, INTERCHANGEABILITY, DESIGN INTEGRITY AND COMPATIBILITY NEEDED TO ASSURE MIL-QUALITY DEVICES

APPROACH:

- USE VENDOR DATA, ELECTRICAL SCHEMATICS AND SUPPLEMENTAL TESTING TO DEVELOP INPUT AND CORRESPONDING OUTPUT PATTERNS AND ALGORITHMS
- DETERMINE ALLOWABLE RESPONSES AND LIMITS TO ELECTRICAL, THERMAL AND MECHANICAL STRESSES
- PROVIDE DATA FOR MIL-M-38510 SLASH SHEETS FOR RAM, ROM, PROM, EPROM AND BUBBLE MEMORIES

PAY OFF:

- RELIABLE HIGH DENSITY SOLID STATE MEMORIES FOR THE MILITARY ENVIRONMENT

TPO/THRUST:

RE/RELIABILITY, MAINTAINABILITY AND COMPATIBILITY

SUB-THRUST:

1/SOLID STATE DEVICE RELIABILITY

BLOCK TITLE:

ELECTRICAL CHARACTERIZATION OF VLSI MICROCIRCUITS 5

OBJECTIVE:

DETERMINE THE PERFORMANCE, INTERCHANGEABILITY, DESIGN INTEGRITY AND COMPATIBILITY NEEDED TO ASSURE MIL-QUALITY DEVICES

APPROACH:

- USE VENDOR DATA, ELECTRICAL SCHEMATICS AND SUPPLEMENTAL TESTING TO DEVELOP INPUT AND CORRESPONDING OUTPUT PATTERNS
- DEVELOP NEW TEST GENERATION/FAULT ISOLATION METHODS FOR VLSICS
- DETERMINE FUNCTIONAL AND PARAMETRIC TESTS AND LIMITS
- PROVIDE DATA FOR MIL-M-38510 SLASH SHEETS FOR SUPER SCHOTTKY LOGIC, ADVANCED MICROPROCESSORS, MICROCOMPUTERS, PERIPHERAL SUPPORT CHIPS AND OTHER VLSI MICROCIRCUITS

PAY OFF:

- RELIABLE ICs FOR THE MILITARY ENVIRONMENT, MORE COST-EFFECTIVE TESTING AND CRITERIA FOR DESIGNING MORE TESTABLE ICs

TPO/THRUST: 4F/RELIABILITY, MAINTAINABILITY AND COMPATIBILITY
SUB-THRUST: 1/SOLID STATE DEVICE RELIABILITY
BLOCK TITLE: QUALITY AND RELIABILITY ASSURANCE AND DESIGN CONCEPTS 7
OBJECTIVE: DEVELOP QRA CONCEPTS, EVALUATE COST/BENEFIT AND PRODUCE A COMPREHENSIVE RELIABILITY DESIGN GUIDE

APPROACH:

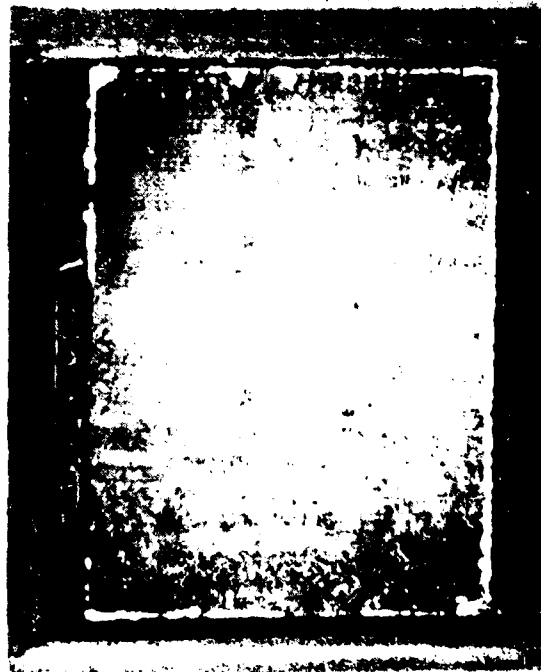
- DEVELOP QA PROCEDURES FOR LSICs, HYBRID ICs AND MICROWAVE TRANSISTORS
- EVALUATE THE COST AND BENEFITS OF MICROCIRCUITS PROCURED TO DIFFERENT QUALITY AND RELIABILITY LEVELS USED IN AIR FORCE EQUIPMENTS
- CORRELATE FIELD FAILURE RATE RESULTS WITH SPECIFIED DEVICE QUALITY LEVELS AND MIL-HDBK-217 MICROCIRCUIT MODELS
- REVISE MIL-STD-883, MIL-M-38510 AND MIL-HDBK-217 IN ACCORD WITH STUDY RESULTS
- MAINTAIN QUALIFIED PARTS LIST AND STATUS OF NEW PARTS QUAL FOR USERS
- DEVELOP COMPREHENSIVE RELIABILITY DESIGN PROCEDURES

PAY OFF:

- NEEDED QRA CONCEPTS AND STANDARDS
- COST/BENEFIT ASSESSMENT OF QA PROCEDURES
- MORE RELIABLE AIR FORCE EQUIPMENT BY DESIGN



LIQUID CRYSTAL TESTING OF MICROPROCESSOR



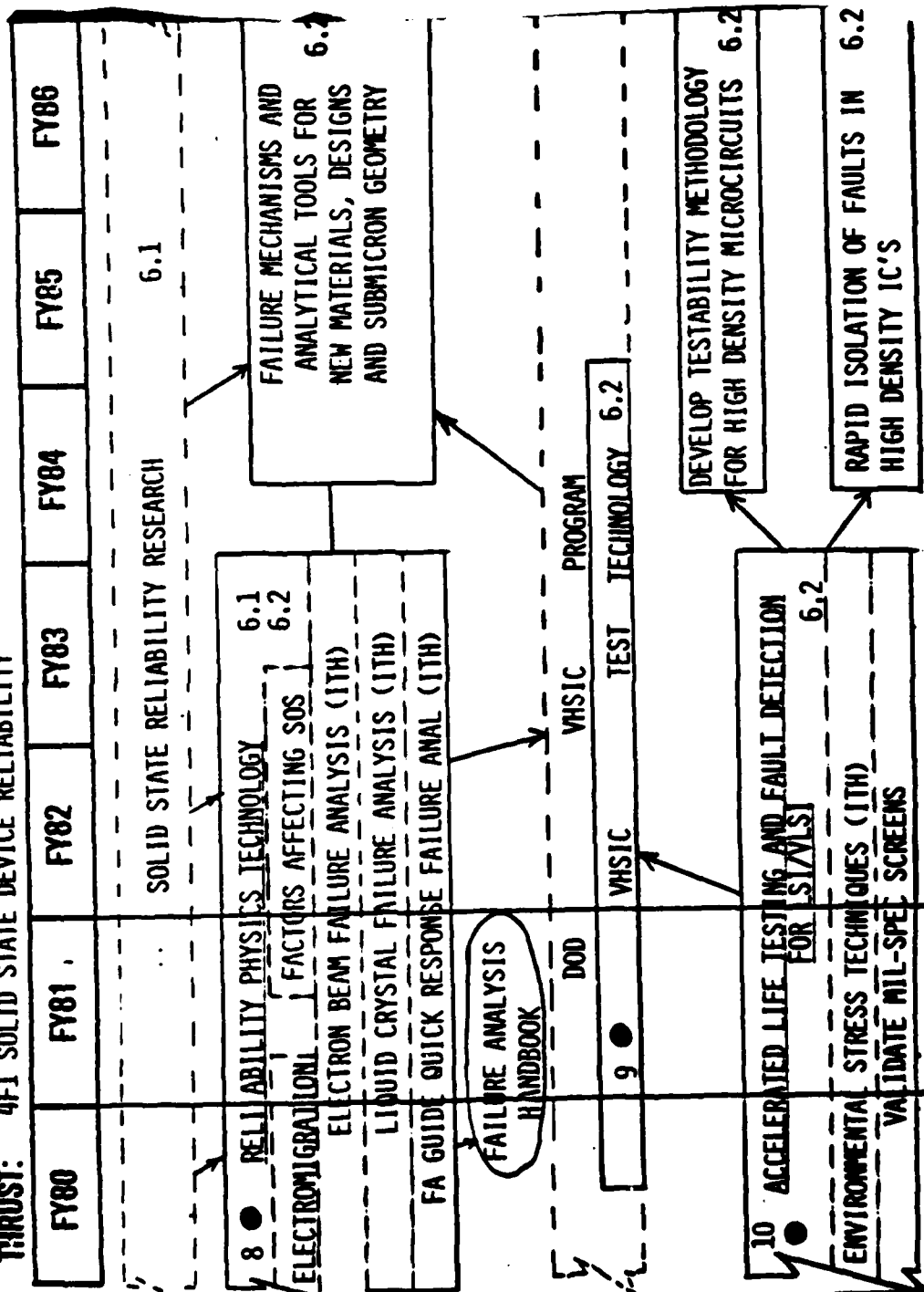
NO BIAS



REGISTER TEST

RADC TPO 4 TECHNOLOGY

THRUST: 4F1 SOLID STATE DEVICE RELIABILITY



IPO/THRUST: 4F/RELIABILITY, MAINTAINABILITY AND COMPATIBILITY

SUB-THRUST: 1/SOLID STATE DEVICE RELIABILITY

BLOCK TITLE: RELIABILITY PHYSICS TECHNOLOGY 8

OBJECTIVE: DEVELOP AN UNDERSTANDING OF AND QUANTIFY THE FACTORS WHICH CAUSE FAILURES
IN SOLID STATE DEVICES

APPROACH:

- INVESTIGATE FACTORS KNOWN TO BE RELIABILITY PROBLEMS
 - ELECTROMIGRATION
 - LOW YIELD AND POOR RELIABILITY OF SILICON ON SAPPHIRE TECHNOLOGY
- DEVELOP LABORATORY CAPABILITY TO EXAMINE SOLID STATE DEVICES AND MEASURE ELECTRICAL AND CHEMICAL PROPERTIES AT THE MICROSCOPIC LEVEL
- DEVELOP A COMBINED ELECTRICAL TEST/E-BEAM PROBE TECHNIQUE FOR DETECTING, LOCATING AND EXAMINING FAULTS ON ICs
- FURTHER REFINE AND APPLY THE LIQUID CRYSTAL TECHNIQUES (LOW VOLTAGE LIQUID CRYSTAL, PATTERN RECOGNITION)

PAY OFF:

- IMPROVED UNDERSTANDING OF FAILURE MECHANISMS: INNOVATIVE FAULT IDENTIFICATION METHODS

TPO/THRUST: 4E/RELIABILITY, MAINTAINABILITY AND COMPATIBILITY
SUB-THRUST: 1/SOLID STATE DEVICE RELIABILITY
BLOCK TITLE: ACCELERATED LIFE TESTING AND FAULT DETECTION FOR LSI/VLSI IC
OBJECTIVE: DEVELOP AND VALIDATE COMPREHENSIVE AND EFFECTIVE MICROCIRCUIT RELIABILITY TEST TECHNIQUES

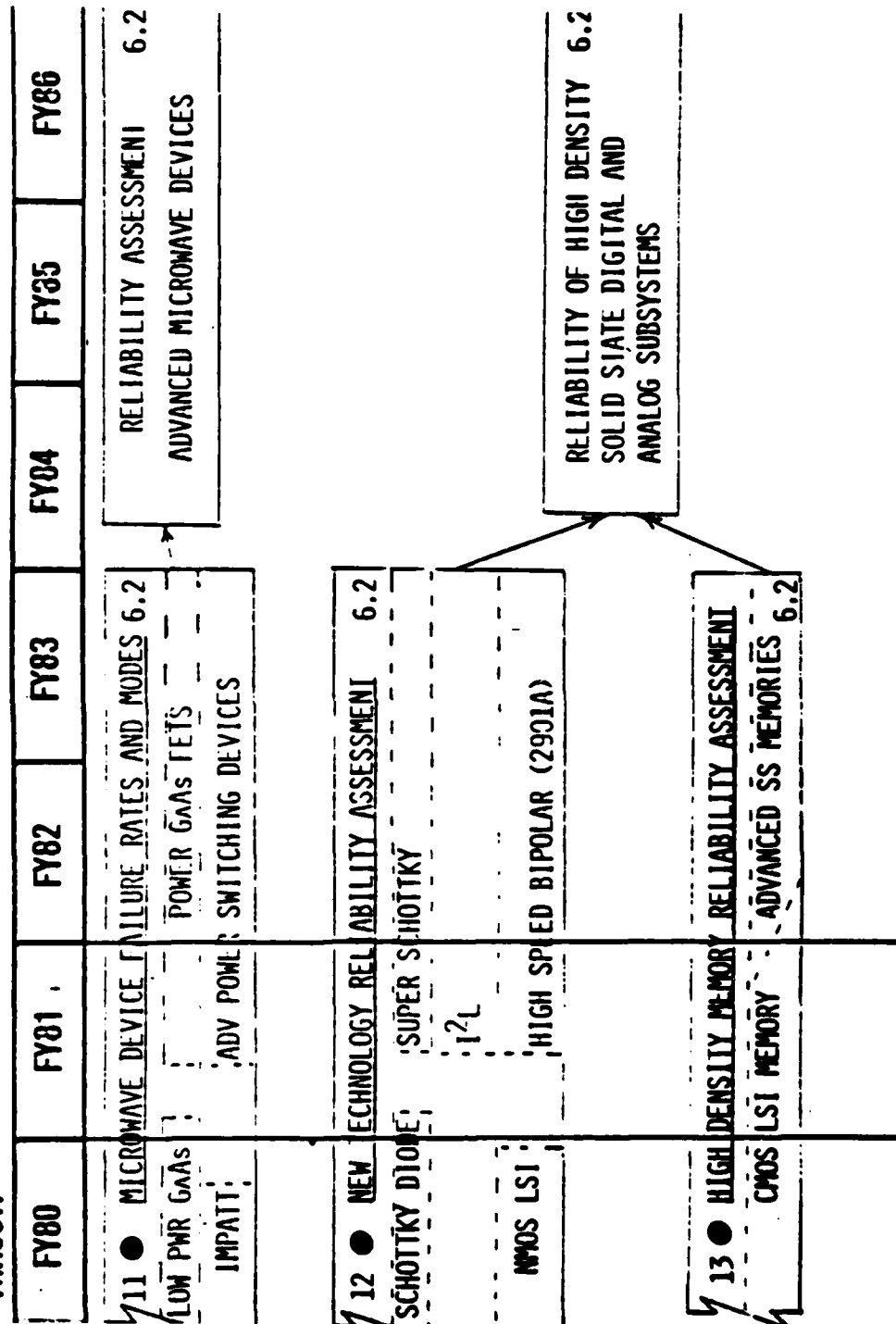
APPROACH:

- DEVELOP AUTOMATIC TEST METHODS FOR LINEAR ICs
 - IDENTIFY ELECTRICAL INDICATORS OF INTERNAL IC QUALITY
 - DEVELOP TESTS TO UTILIZE EXPANDED TEKTRONICS 3270 TESTER CAPABILITY
 - REFINE PARALLEL TEST METHOD
 - EXPLORE OTHER ACCELERATED TEST AND FAULT DETECTION TECHNIQUES
-
- FASTER, HIGHER CONFIDENCE IC SCREENING TEST METHODS
 - RAPID ACCELERATED LIFE TEST METHODS FOR NEW TECHNOLOGIES
 - MORE ACCURATE MIL SPEC TEST REQUIREMENTS

PAY OFF:

RADC TP0 4 TECHNOLOGY

THRUST: 4F1 SOLID STATE DEVICE RELIABILITY



TPO/THRUST: 4F/RELIABILITY, MAINTAINABILITY AND COMPATIBILITY
SUB-THRUST: 1/SOLID STATE DEVICE RELIABILITY
BLOCK TITLE: MICROWAVE DEVICE FAILURE RATES AND MODES II
OBJECTIVE: DETERMINE FAILURE RATE AND CAUSE OF FAILURE IN STATE-OF-THE-ART MICROWAVE DEVICES

APPROACH:

- SELECT REPRESENTATIVE POWER GAAs FETs AND ADVANCED POWER SWITCHING DEVICES
- APPLY ACCELERATED LIFE TESTS
- EXAMINE FAILED DEVICES AND DETERMINE CAUSE
- TRANSFER RESULTS AND CONCLUSIONS TO VENDORS AND SYSTEM DESIGNERS
- FEEDBACK TO DEVICE VENDORS TO CORRECT PROBLEMS
- DEFINITION OF DEVICE TOLERANCE PARAMETERS
- RELIABLE, SUPPORTABLE SYSTEM DESIGN

PAY OFF:

TPO/THRUST: 4E/RELIABILITY, MAINTAINABILITY AND COMPATIBILITY
SUB-THRUST: 1/SOLID STATE DEVICE RELIABILITY
BLOCK TITLE: NEW TECHNOLOGY RELIABILITY ASSESSMENT 12
OBJECTIVE: DETERMINE FAILURE RATE AND CAUSE OF FAILURE IN NEW SOLID STATE TECHNOLOGIES
APPROACH:

- SELECT DEVICES REPRESENTATIVE OF SUPER SCHOTTKY, $1\frac{1}{2}$ AND HIGH SPEED BIPOLAR
- APPLY ACCELERATED LIFE TESTS
- APPLY MIL SPEC SCREEN TESTS WHERE AVAILABLE TO DETECT FAULTS

PAY OFF:

- EARLY FAILURE RATE DATA FOR SYSTEM DESIGNERS
- FEEDBACK TO MIL SPECS IMPROVES ACCURACY
- FEEDBACK TO DEVICE VENDOR TO CORRECT PROBLEMS

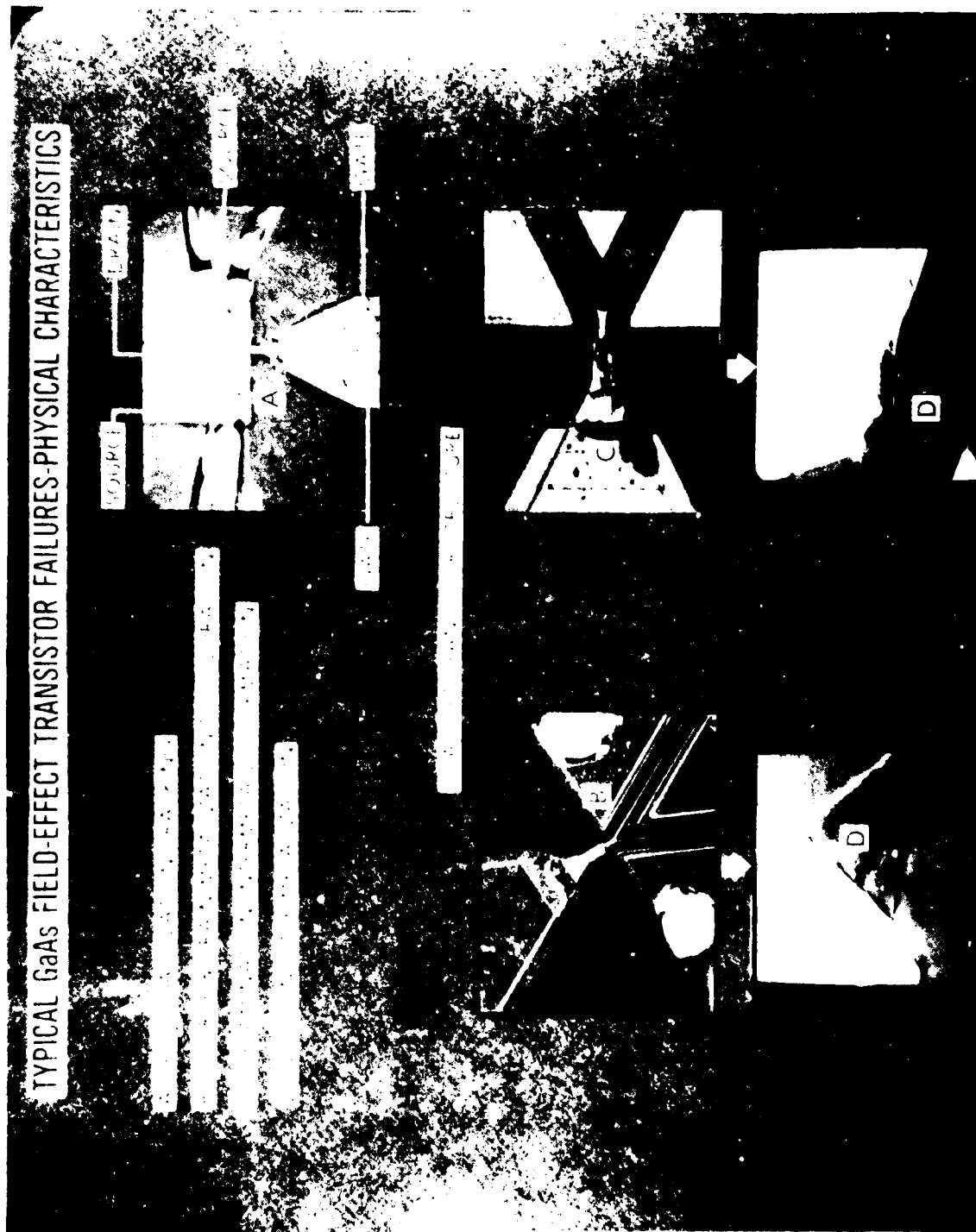
TPO/THRUST: 4F/RELIABILITY, MAINTAINABILITY AND COMPATIBILITY
SUB-THRUST: 1/SOLID STATE DEVICE RELIABILITY
BLOCK TITLE: HIGH DENSITY MEMORY RELIABILITY ASSESSMENT 13
OBJECTIVE: DETERMINE FAILURE RATE AND CAUSE OF FAILURE IN NEW SOLID STATE MEMORY TECHNOLOGIES

APPROACH:

- SELECT DEVICES REPRESENTATIVE OF 64 KBIT DYNAMIC, 16K BIT STATIC, AND NONVOLATILE REPROGRAMMABLE ROMS
- APPLY ACCELERATED LIFE TESTS
- APPLY MIL SPEC SCREEN TESTS WHERE AVAILABLE TO DETECT FAULTS
- EXAMINE FAILED DEVICES AND DETERMINE CAUSE
- EARLY FAILURE RATE DATA FOR SYSTEM DESIGNERS
- FEEDBACK TO MIL SPECS IMPROVES ACCURACY
- FEEDBACK TO DEVICE VENDOR TO CORRECT PROBLEMS

PAY OFF:

TYPICAL GaAs FIELD-EFFECT TRANSISTOR FAILURES-PHYSICAL CHARACTERISTICS



**SOLID STATE DEVICE RELIABILITY
KEY PERSONNEL**

JOSEPH BRAUER

**CHIEF, R&R
(315)-330-3396**

EDWARD O'CONNELL

**RELIABILITY ASSURANCE SECTION
(315)-330-2047**

ROBERT THOMAS

**PRODUCT EVALUATION SECTION
(315)-330-4632**

ALFRED TAMBURRINO

**RELIABILITY PHYSICS SECTION
(315)-330-2813**

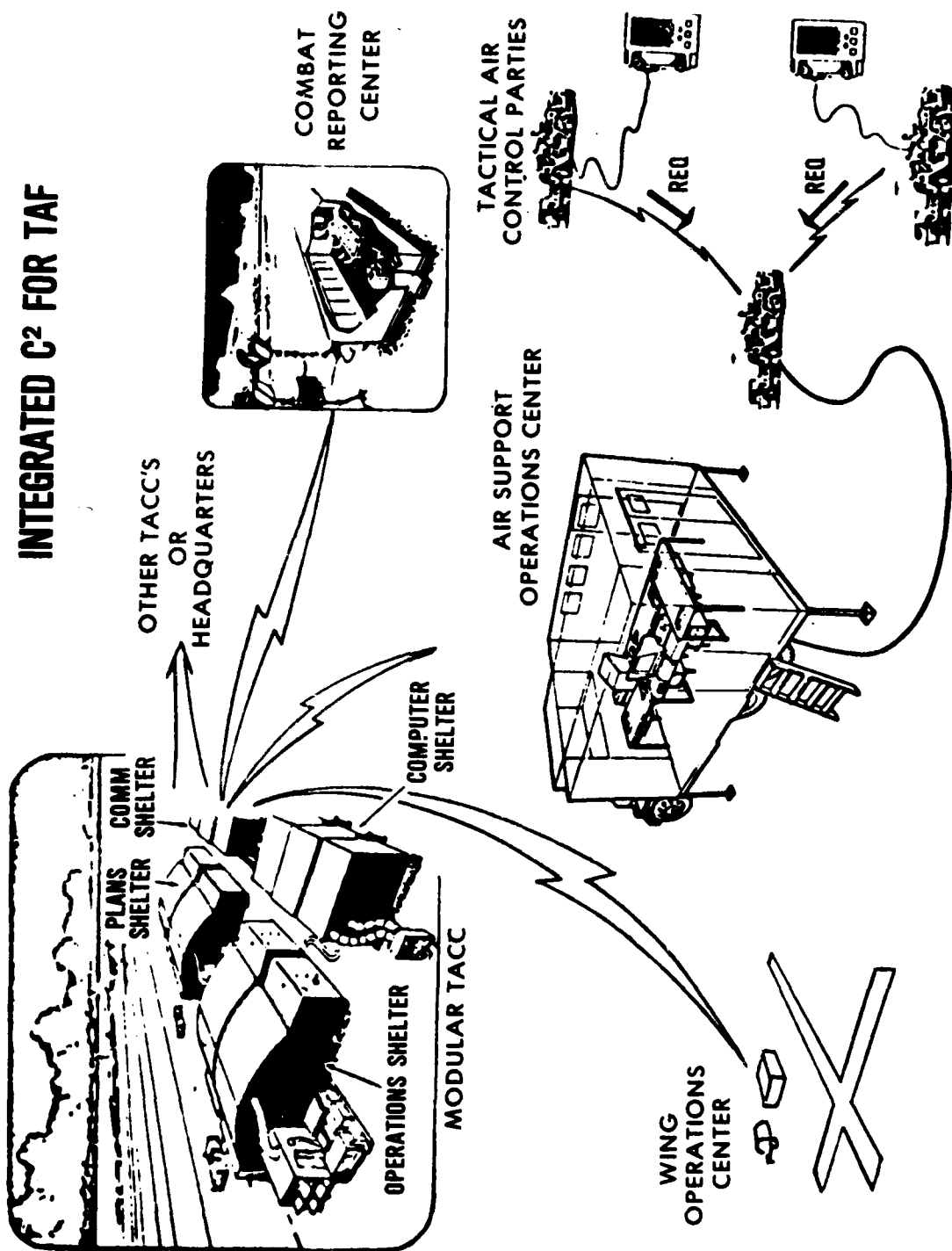
INDUSTRY LOOKS AT RADC 1980

INFORMATION PROCESSING STRUCTURES SUBTHIRUST - TP06G1

INFORMATION PROCESSING DATABASES SUBTHIRUST - TP06G2

RICHARD A. NETZGER
INTERACTIVE PROCESSING SECTION
ISCP/2846

INTEGRATED C² FOR TAF



INTEGRATED C² FOR TAF

OBJECTIVES:

- **ELIMINATE CHOKEPOINTS THRU DECISION AIDS**
 - DATA AGGREGATION & DISPLAY
 - REAL TIME OPTION GENERATION
- **DEVELOP GENERALIZED DATA SHARING FOR DECENTRALIZED OPERATIONS**
- **DEVELOP CAPABILITY TO ESTABLISH BACK-UP OPERATION**
- **DEMONSTRATE CAPABILITIES IN REALISTIC USER ENVIRONMENT**
 - OPERATIONAL COMPUTERS
 - EXPANDABLE ARCHITECTURE

INTEGRATED C² FOR TAF

APPROACH:

- ESTABLISH COMPARABLE C' COMPUTER ENVIRONMENT
- DEMONSTRATE BUSS ORIENTED C' CENTER
- DEMONSTRATE C' CENTER INTERNETTING
- DEMONSTRATE SOFTWARE IMPLEMENTATIONS OF

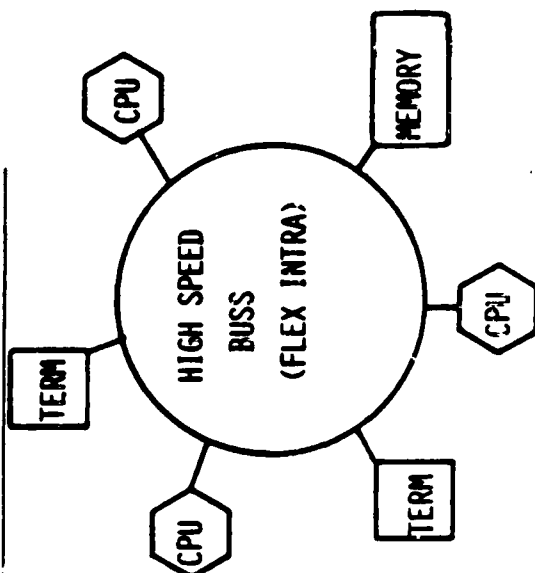
DECISION AIDS

SYSTEM SOPHISTICATION

STAND ALONE SYSTEMS	SYSTEMS EXCHANGE BIT STREAMS	OPERATING SYSTEMS INTERACT	APPLICATIONS LEVELS INTERACT
<ul style="list-style-type: none"> • VERBAL & RECORD COMM • CENTRALIZED DATA • AUTONOMOUS • MANUAL INTERFACE TO OTHER SYSTEMS 	<ul style="list-style-type: none"> • TOPOLOGY • TRANSPORT PROTOCOL (X.25, HDLC) • REMOTE TERMINAL ACCESS • SIMPLE FILE TRANSFER 	<ul style="list-style-type: none"> • HOMOGENEOUS/HETEROGENEOUS • INTER PROCESS COMM • PROCESS INITIATION • STRUCTURED FILE TRANSFER • NETWORK OPERATING SYSTEM • TASK ALLOCATION • COMMON COMMAND LANGUAGE • FUNCTIONAL ALLOCATION 	<ul style="list-style-type: none"> • HOMOGENEOUS/HETEROGENEOUS • GLOBAL TASK SCHEDULING • PROCESS MIGRATION • DISPERSED DMS • CONCURRENCY CONTROL • SYNCHRONIZATION • DISTRIBUTED OPERATING SYS • SHARED RESOURCES
EXAMPLES			
<ul style="list-style-type: none"> • 407L • AIRLINE RESERVATION 	<ul style="list-style-type: none"> • 485L • MSG HANDLING • RJE SYSTEMS • ARPANET 	<ul style="list-style-type: none"> • WIN • RSEXC • DECNET • SNA • DAIS 	<ul style="list-style-type: none"> • WWMCCS/IDHS • XNDM • ADAPT • ASATI

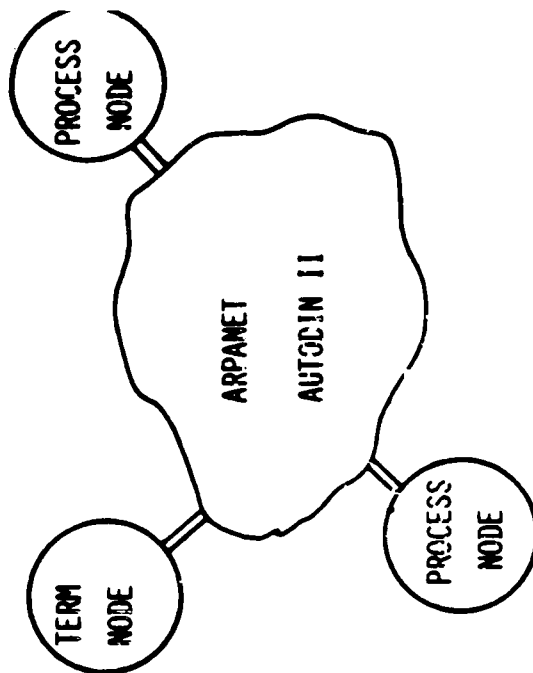
DISTRIBUTED SYSTEM STRUCTURES

BUSS COUPLED DISTRIBUTED OS



- HIGH BANDWIDTH
- TIGHT COUPLING
- SHARED RESOURCES
- RAPID RESPONSE
- CO-LOCATED RESOURCES

DISPERSED NETWORK DISTRIBUTED



- LOW BANDWIDTH
- LOOSE COUPLING
- COOPERATIVE PROCESSES
- SLOW RESPONSE
- GEOGRAPHICALLY DISPERSED

DISTRIBUTED SYSTEM ARCHITECTURE AND CONTROL

CURRENT TECHNOLOGY ISSUES

LEVEL OF CONTROL CENTRALIZATION
CENTRALIZED/DETERMINISTIC
DECENTRALIZED/NON-DETERMINISTIC

LOCAL OPERATING SYSTEM AUTONOMY

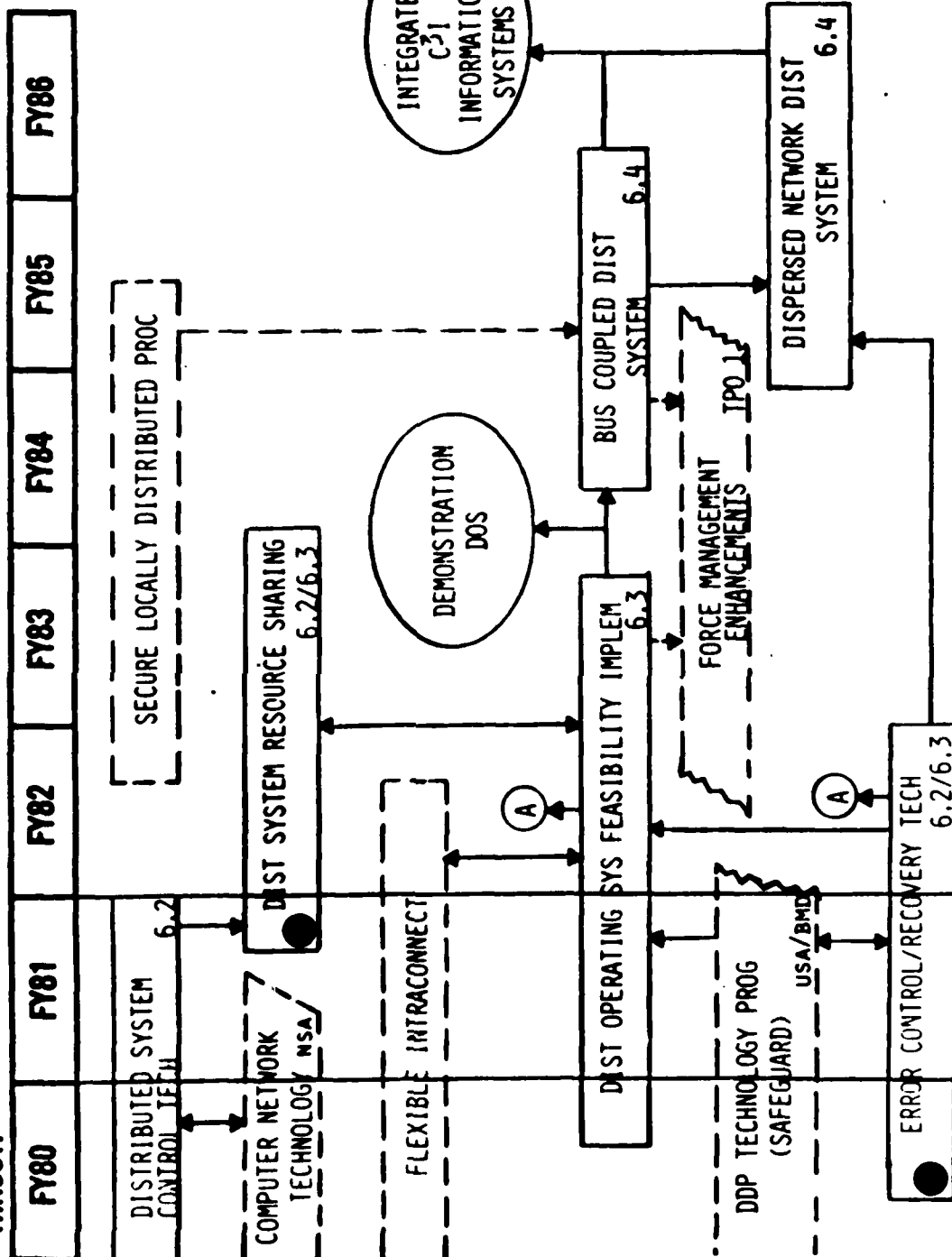
INTERPROCESS COMMUNICATION

TRANSPARENCY - USER LEVEL

ERROR CONTROL

RESOURCE SHARING

**RADC TPO 4 TECHNOLOGY
THRUST: 461 C-1 SYSTEM STRUCTURES**



TPO/THRUST #TITLE: 46 INFORMATION PROCESSING

SUB-THRUST #TITLE: 461 C³I SYSTEM STRUCTURES

BLOCK TITLE: DISTRIBUTED SYSTEM RESOURCE SHARING

OBJECTIVE: • TO PROVIDE SOFTWARE CONTROL MANAGEMENT WHICH MUST PRESENT TO THE USER THE
WHOLE SET OF DISTRIBUTED RESOURCES AS BELONGING TO A SINGLE MACHINE

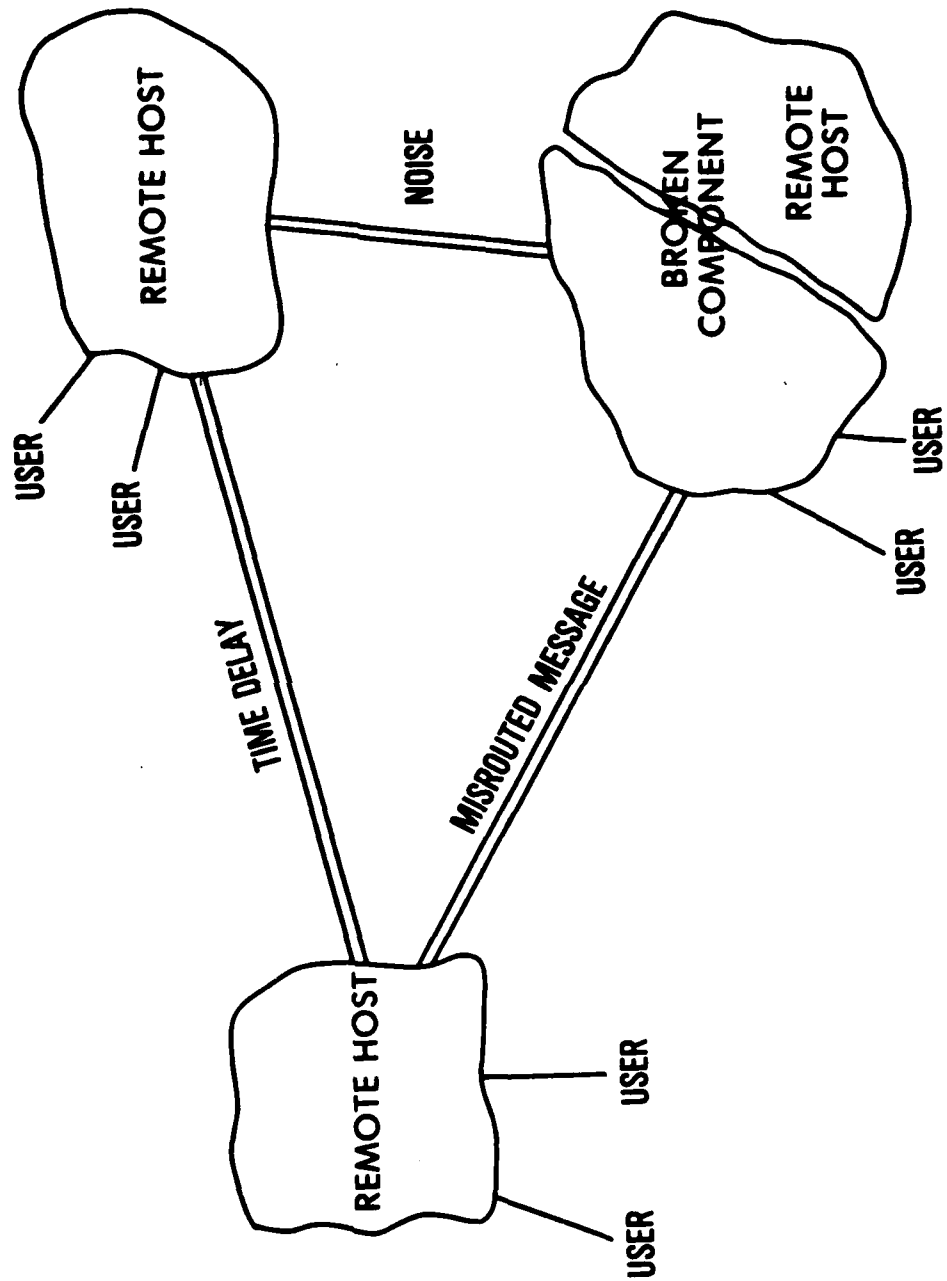
TECHNICAL APPROACH: • DEVELOP ALGORITHMS AND DEMONSTRATION SOFTWARE

- DISTRIBUTED TASK EXECUTION
- DISTRIBUTED SYSTEM EXECUTIVE CONTROL
- SYSTEM PRIMITIVES TO STRUCTURE AND MODIFY CONFIGURATION

PAY-OFF: • INCREASED PROCESSING EFFICIENCY

- LOAD LEVELING
- RECONFIGURABILITY

DISTRIBUTED SYSTEM FAULTS



TPO/THRUST #TITLE: 46 INFORMATION PROCESSING

THRUST/SUB-THRUST/SUB-THRUST #TITLE: 461 C³I SYSTEM STRUCTURES

BLOCK TITLE: ERROR CONTROL/RECOVERY TECHNIQUES

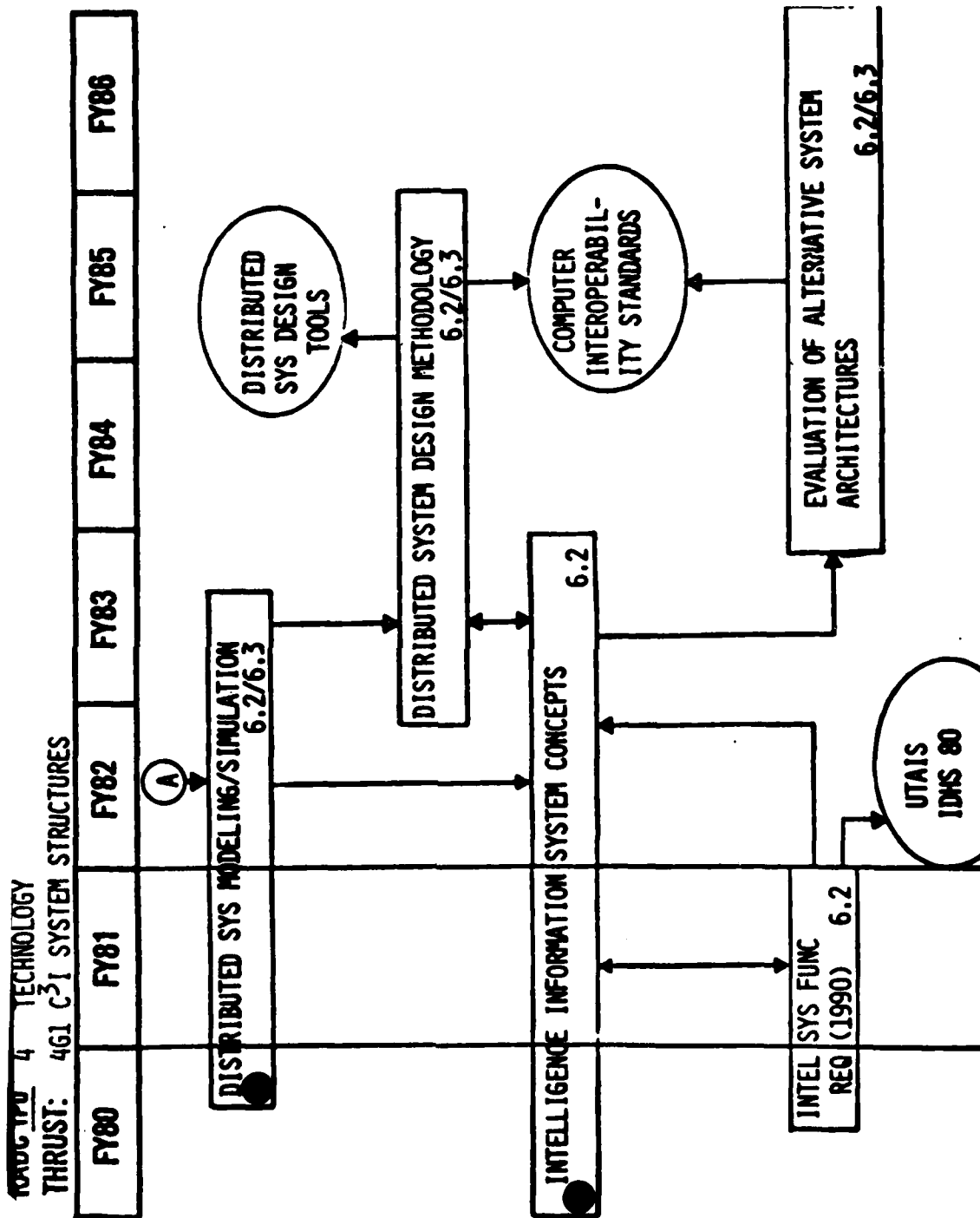
OBJECTIVE: • ESTABLISH FEASIBILITY OF ERROR DETECTION, ISOLATION AND
RECOVERY TECHNIQUES

• DEVELOP METHODOLOGY FOR ALGORITHM VERIFICATION

TECHNICAL APPROACH: DEVELOPMENT OF TECHNIQUES, TOOLS, MODELS AND SOFTWARE TO ADDRESS:

- EFFECTS OF SYSTEM PARTITIONING
- TASK PERSISTENCE/REINITIATION
- SYSTEM RECONFIGURATION

PAY-OFF: THIS WORK IS FUNDAMENTAL TO THE ACHIEVEMENT OF SURVIVABILITY IN A DISTRIBUTED
SYSTEM THROUGH RESOURCE REALLOCATION.



TPO/THRUST #TITLE: 46 INFORMATION PROCESSING

SUB-THRUST #TITLE: 461 C³I SYSTEM STRUCTURES

BLOCK TITLE: DISTRIBUTED SYSTEM MODELING/SIMULATION

OBJECTIVE: TO DEVELOP A COMPREHENSIVE MODELING AND SIMULATION CAPABILITY TO ALLOW EVALUATION OF THE PERFORMANCE, ROBUSTNESS AND SURVIVABILITY OF DISTRIBUTED SYSTEMS.

TECHNICAL APPROACH: ADAPT EXISTING CAPABILITIES FOR PERFORMANCE MODELS TO INCORPORATE DISTRIBUTION OF FUNCTIONS. DEVELOP CAPABILITY TO MODEL RELIABILITY AND ERROR CONDITIONS OF A DISTRIBUTED ADP SYSTEM.

PAY OFF: HIGH

TPO/THRUST #TITLE: 4G INFORMATION PROCESSING

SUB-THRUST #TITLE: 4G1 C³I SYSTEM STRUCTURES

BLOCK TITLE: INTELLIGENCE INFORMATION SYSTEM CONCEPTS

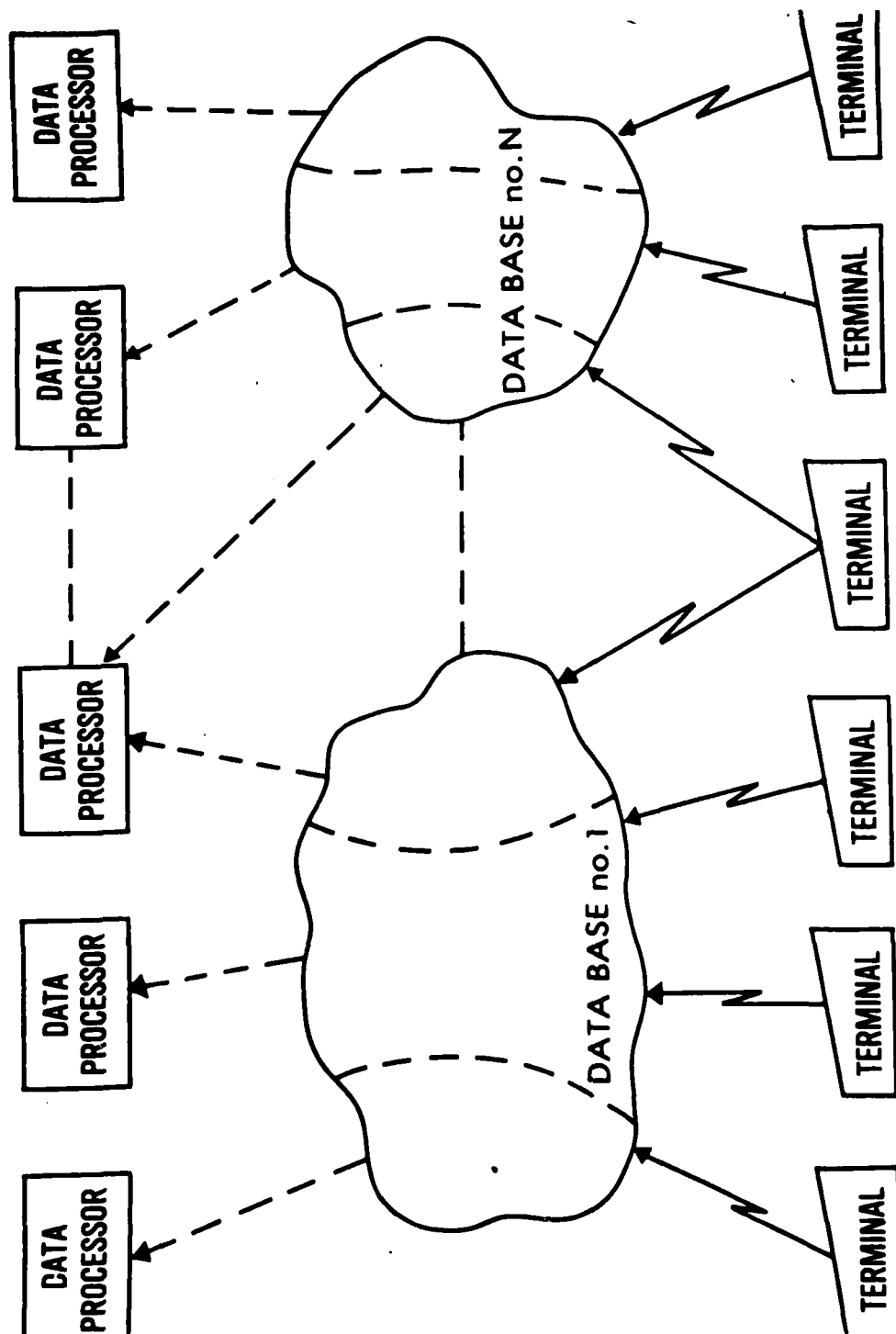
OBJECTIVE: TO EXPLORE POTENTIAL INFORMATION SYSTEM CONCEPTS FOR SATISFYING/SOLVING THE THROUGHPUT, CAPACITY, AND RESPONSIVENESS REQUIREMENTS IMPOSED ON INTELLIGENCE PROCESSING SYSTEMS.

TECHNICAL APPROACH: HIGH TECHNOLOGY INFORMATION PROCESSING TECHNIQUES (HARDWARE & SOFTWARE EMERGING FROM GOVERNMENT 6.1, COMMERCIAL INDUSTRY AND UNIVERSITY RESEARCH WILL BE ANALYZED FOR POTENTIAL CONTRIBUTION TO THE REQUIREMENT STATED IN THE ABOVE OBJECTIVE.

PAY-OFF: THE PAY-OFF IS IN THE POTENTIAL TO ACHIEVE THE PROCESSING CAPACITIES TO EFFECTIVELY UTILIZE AND SUPPLY ESSENTIAL INFORMATION FOR INTELLIGENCE AND STRIKE SYSTEMS OF THE 1990 TIMEFRAME.

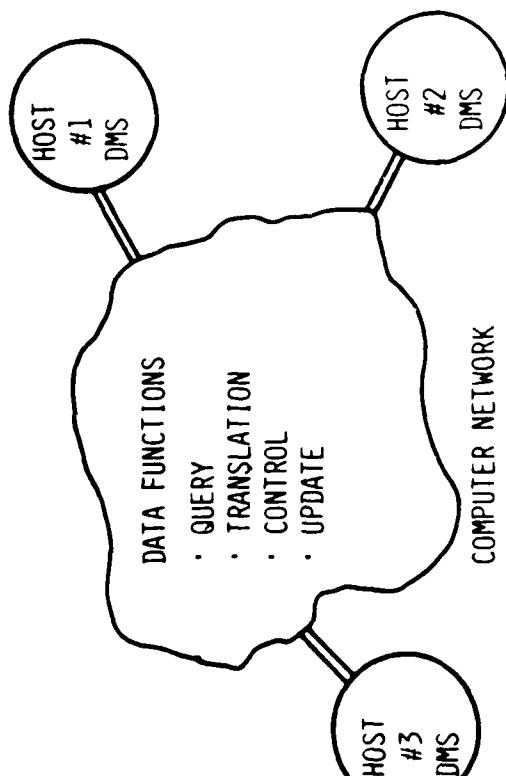
INFORMATION PROCESSING DATABASES SUBTHRUST - IP04G2

DISTRIBUTED DATA BASE PROBLEM



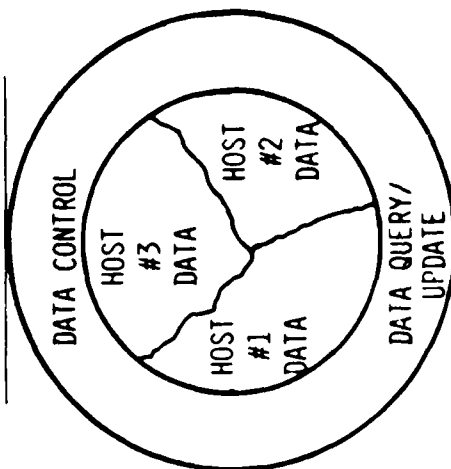
DISTRIBUTED DATA SYSTEMS

NETWORKED DATA SYSTEM



- AUTONOMOUS DMS'S
- TRANSPARENT ACCESS
- NETWORK OVERHEAD
- SYNCHRONIZATION/CONCURRENCY

INTEGRATED DATA SYSTEM



- INTEGRATED DATA STRUCTURE
- GLOBAL CONTROL
- UNIFIED QUERY/UPDATE CAPABILITY
- PARTITIONING/ALLOCATION
- SYNCHRONIZATION/CONCURRENCY

DISTRIBUTED DATABASES

CURRENT TECHNOLOGY ISSUES

DATABASE INTEROPERABILITY

MULTIUSER ACCESS

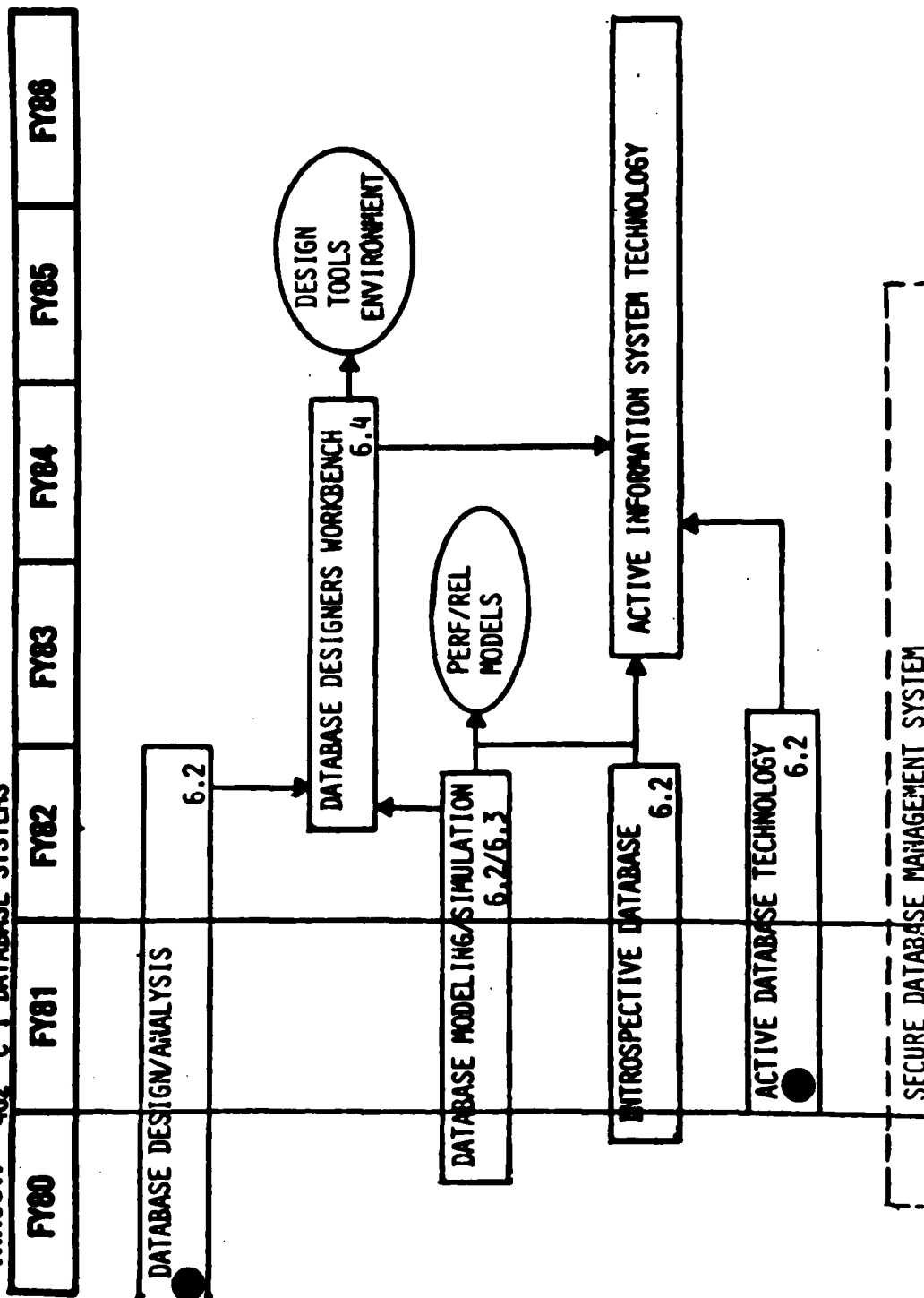
DISTRIBUTED DATABASE DESIGN

CONCURRENCY CONTROL/SYNCHRONIZATION

USER INTERFACE

RADC TPO 4 TECHNOLOGY

THRUST: 462 C³I DATABASE SYSTEMS



TPO/THRUST #TITLE: 46 INFORMATION PROCESSING

SUB-THRUST #TITLE: 462 C³I DATABASE SYSTEMS

BLOCK TITLE: DATABASE DESIGN/ANALYSIS

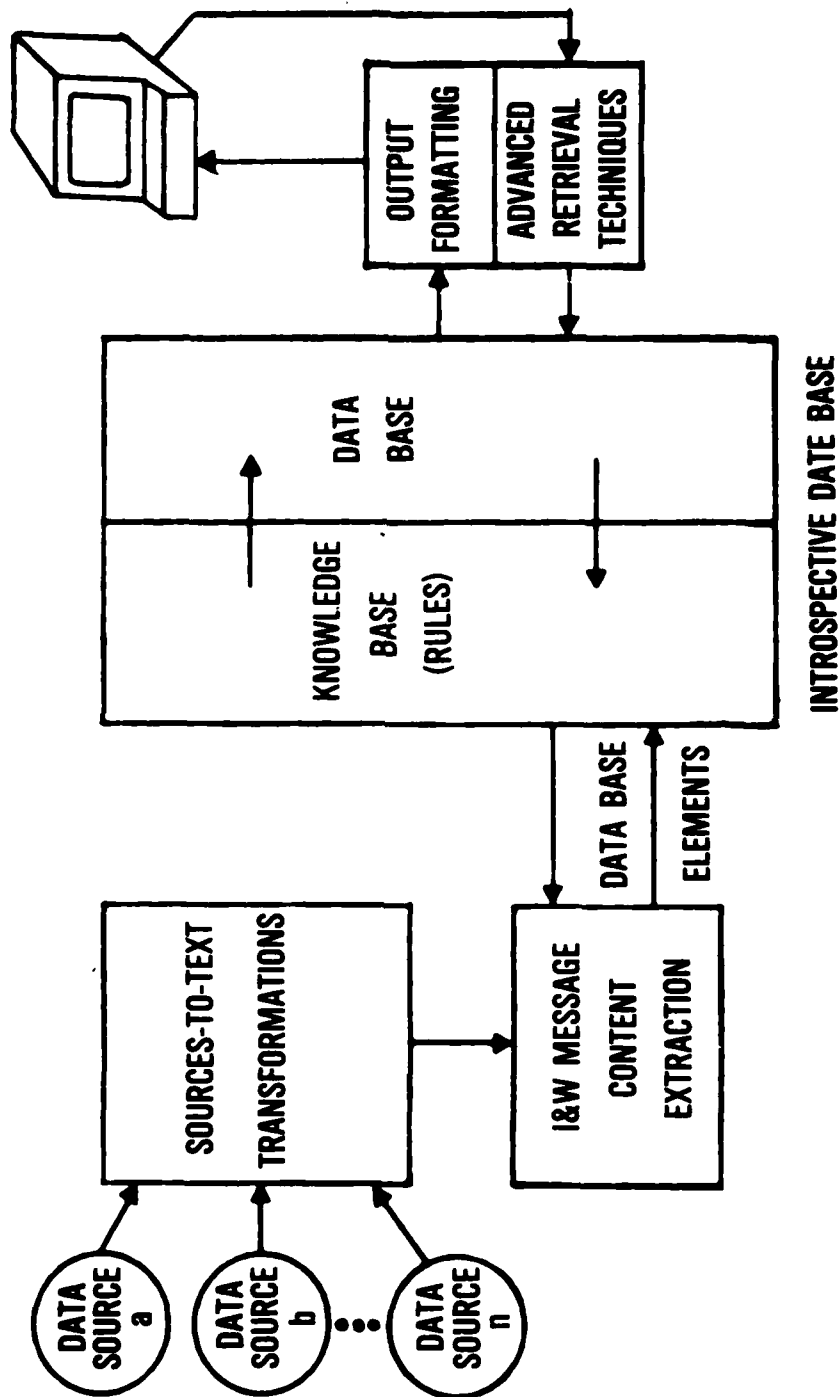
OBJECTIVE: DEVELOP AND EVALUATE DATABASE DESIGN TOOLS FOR SINGLE AND MULTINODE SYSTEMS. ANALYZE AND DESIGN A STRUCTURE FOR INTEGRATING THESE TOOLS.

TECHNICAL APPROACH:• INSTALL AND EVALUATE TOOLS DEVELOPED AND COLLECTED UNDER PREVIOUS EFFORT:

- IDENTIFY FORMATS AND INTERFACE PARAMETERS.
- DESIGN A STRUCTURE TO TIE THE TOOLS TOGETHER.

PAY OFF: SUPPORTS RAPID AND EFFECTIVE DEVELOPMENT AND EVALUATION OF DATA BASE SYSTEMS.

ACTIVE SYSTEMS/KNOWLEDGE PROCESSING



TPO/THRUST #TITLE: 46 INFORMATION PROCESSING

SUB-THRUST #TITLE: 462 C³I DATA BASE SYSTEMS

BLOCK TITLE: ACTIVE DATA BASE TECHNOLOGY

OBJECTIVE: PERMIT COMPONENTS OF DATA STRUCTURE TO ACTIVELY PROCESS INCOMING DATA:

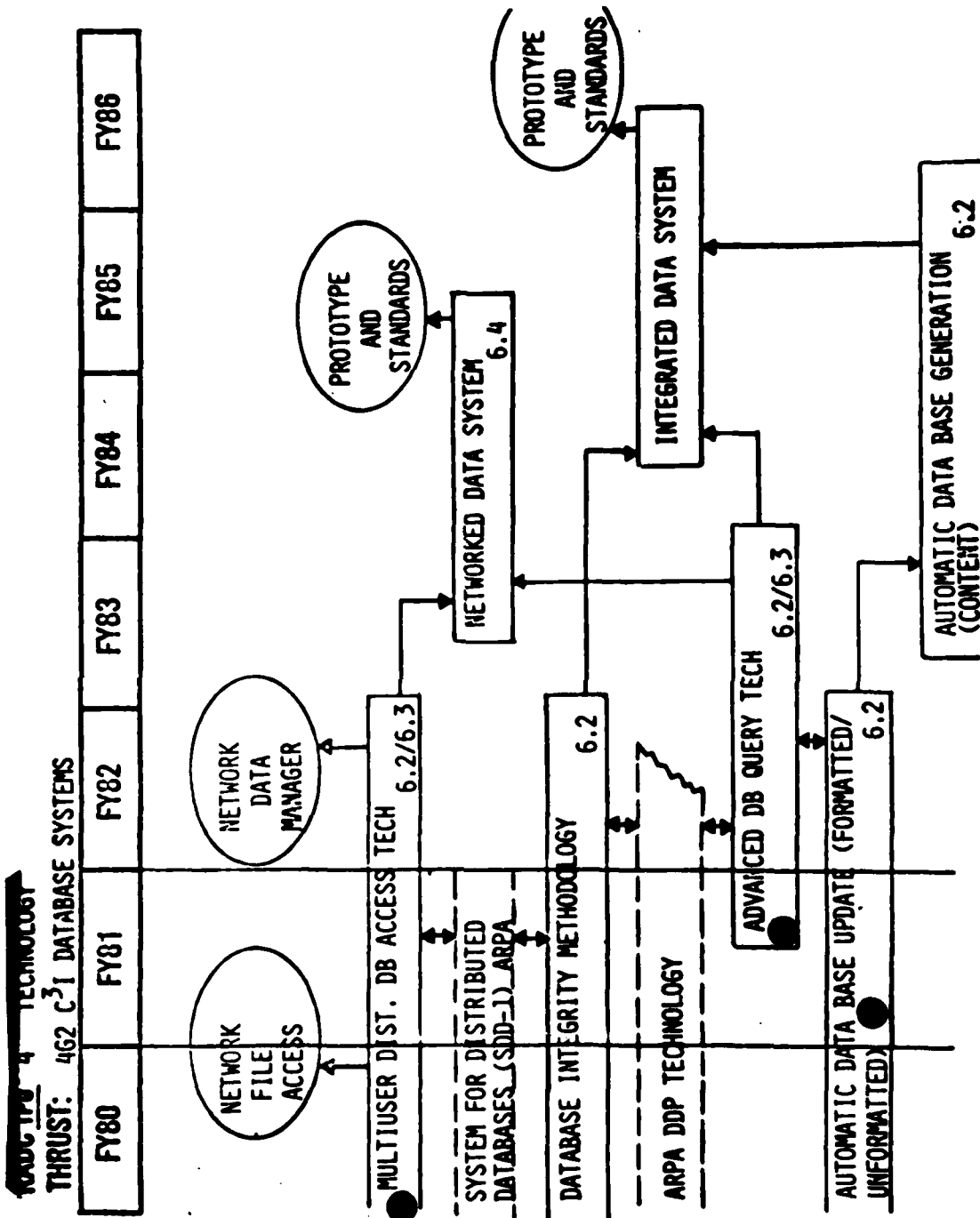
- TRACK INTERNALLY DERIVED INFORMATION GOALS
- PERFORM INDUCTION AND DEDUCTION
- ALERT WHEN CONDITIONS SATISFIED

TECHNICAL APPROACH: • DEVELOP ALGORITHMS TO ORGANIZE AND ADAPT INCOMING DATA

- ARTIFICIAL INTELLIGENCE
- COMPUTATIONAL LINGUISTICS

PAY-OFF: • EXTEND EXPERT ANALYST CAPABILITY

- DECREASE ANALYSIS TIME
- SIMPLIFY INTERROGATION TASKS



TPO/THRUST #TITLE: 4G INFORMATION PROCESSING

SUB-THRUST #TITLE: 4G2 C³I DATABASE SYSTEMS

BLOCK TITLE: MULTI USER DISTRIBUTED DATABASE ACCESS TECHNOLOGY

OBJECTIVE: TO INVESTIGATE THE ISSUES INVOLVED IN PROVIDING ACCESS TO DISSIMILAR DATABASES AND DATA MANIPULATION CAPABILITIES IN NETWORKS OF HETEROGENEOUS HARDWARE AND SOFTWARE SYSTEMS.

TECHNICAL APPROACH: DEVELOP TECHNOLOGY TO PROVIDE:

- DATA ELEMENT LEVEL INTERCHANGE BETWEEN DISSIMILAR DBMS's.
- DEVELOP A NETWORK DATA MANAGER TO PROVIDE QUERY TRANSLATION, DATA TRANSFORMATION AND DATA INTEGRITY IN A NETWORKED SYSTEM.
- INVESTIGATE ISSUES OF USER INTERFACE, AND EVALUATE DEVELOPED TECHNIQUES IN THE NETWORK INTERFACE FACILITY.

PAYOFF: HIGH. THE ABILITY TO EFFECTIVELY ACCESS AND MIGRATE DATA IN A DISTRIBUTED SYSTEM IS CRITICAL TO SYSTEM SURVIVABILITY.

TPD/THRUST #TITLE: 46 INFORMATION PROCESSING

SUB-THRUST #TITLE: 462 C³I DATABASE SYSTEMS

BLOCK TITLE: ADVANCED DATABASE QUERY TECHNIQUES

OBJECTIVE:

- ANALYZE USER DATA MANIPULATION CAPABILITY
- DEVELOP DATA QUERY/MANIPULATION

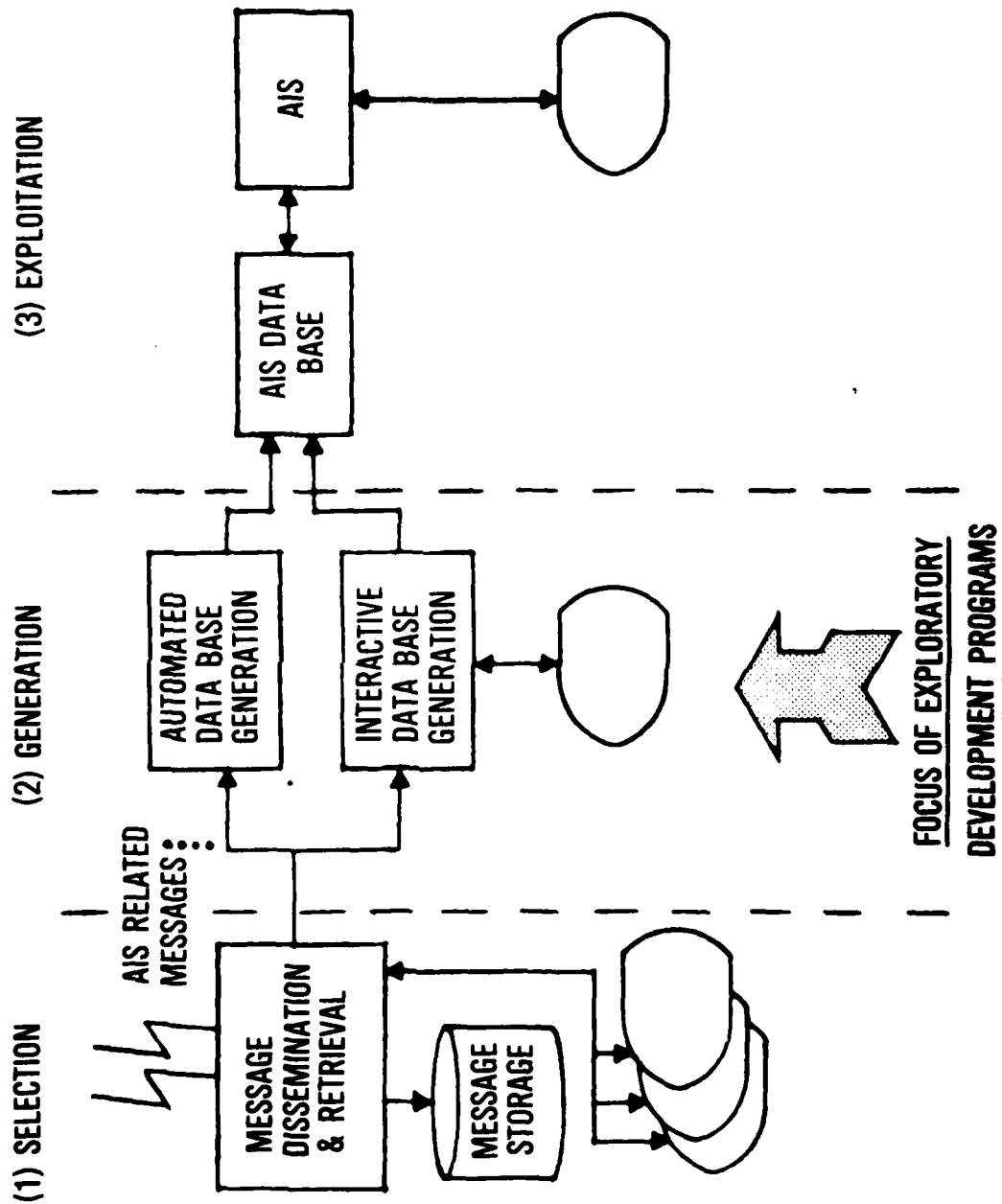
- NETWORKED SYSTEM
- HETEROGENEOUS HARDWARE
- DISSIMILAR DATABASE SYSTEMS

TECHNICAL APPROACH: DEVELOP AND DEMONSTRATE ALGORITHMS TO SUPPORT:

- ACCESS PLANNING
- NATURAL LANGUAGE USER INTERFACE
- COMMON QUERY ACROSS MULTIPLE HETEROGENEOUS SYSTEMS

PAY-OFF: THE ABILITY TO PROVIDE COMMON ACCESS TO HETEROGENEOUS DBMS THROUGH COMMON SYNTAX AND SEMANTICS OF QUERY LANGUAGE.

COMPONENTS OF AN EXPERIMENTAL MESSAGE EXPLOITATION SYSTEM



TPO/THRUST #TITLE: 46 INFORMATION PROCESSING

SUB-THRUST #TITLE: 4G2 C³I DATABASE SYSTEMS

BLOCK TITLE: AUTOMATIC DATABASE UPDATE

OBJECTIVE: DEVELOP LINGUISTIC TECHNIQUES:

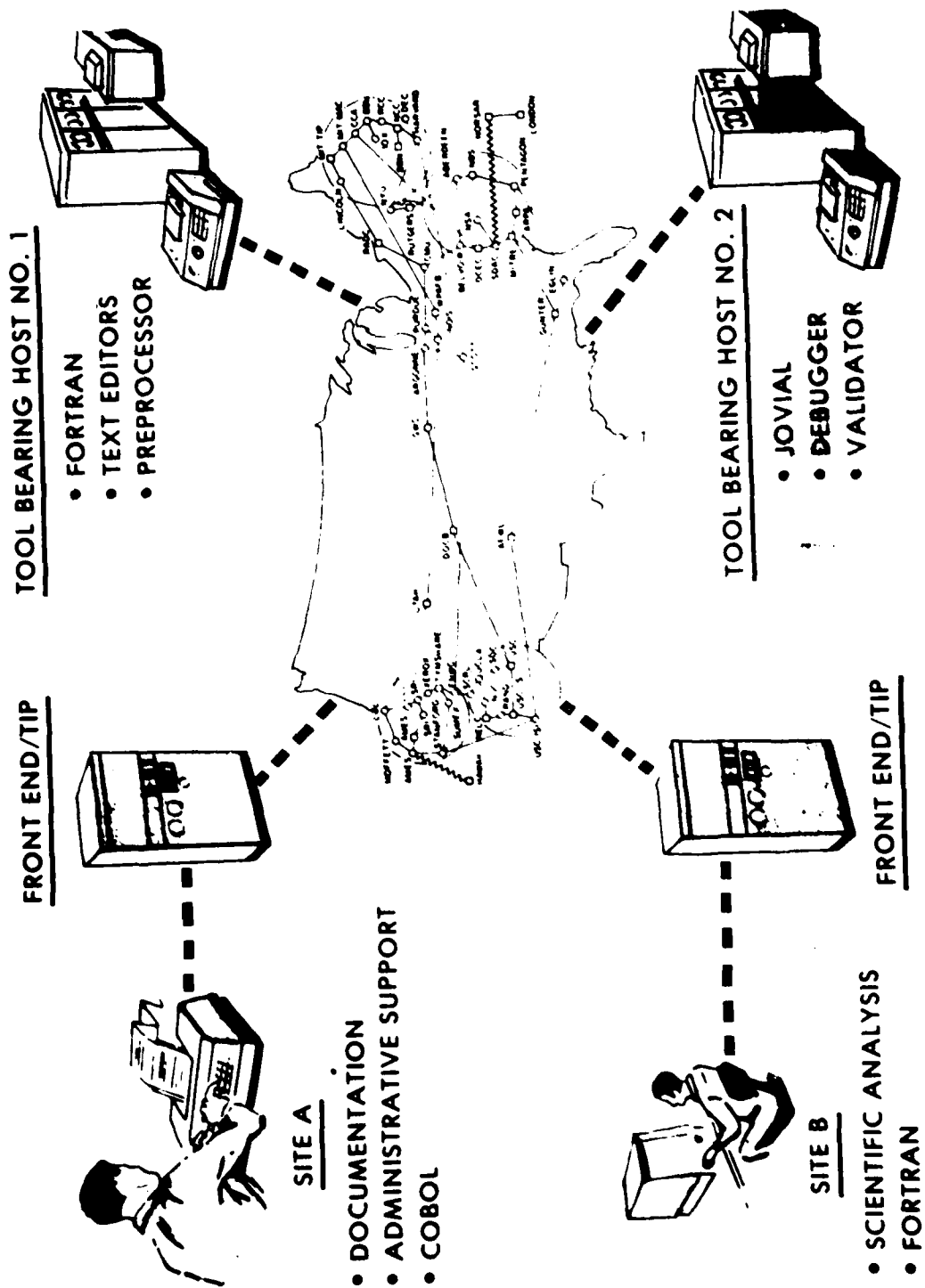
- EXTRACT DATA ELEMENTS FROM MESSAGES
- AUTOMATICALLY UPDATE DATABASE

TECHNICAL APPROACH: ALGORITHM DEVELOPMENT AND DEMONSTRATION FOR:

- SEMANTIC AND SYNTACTIC PROCESS OF MESSAGES
- EXTRACTION OF DATA ELEMENTS
- CORRELATION TO AND INSERTION INTO DATABASE

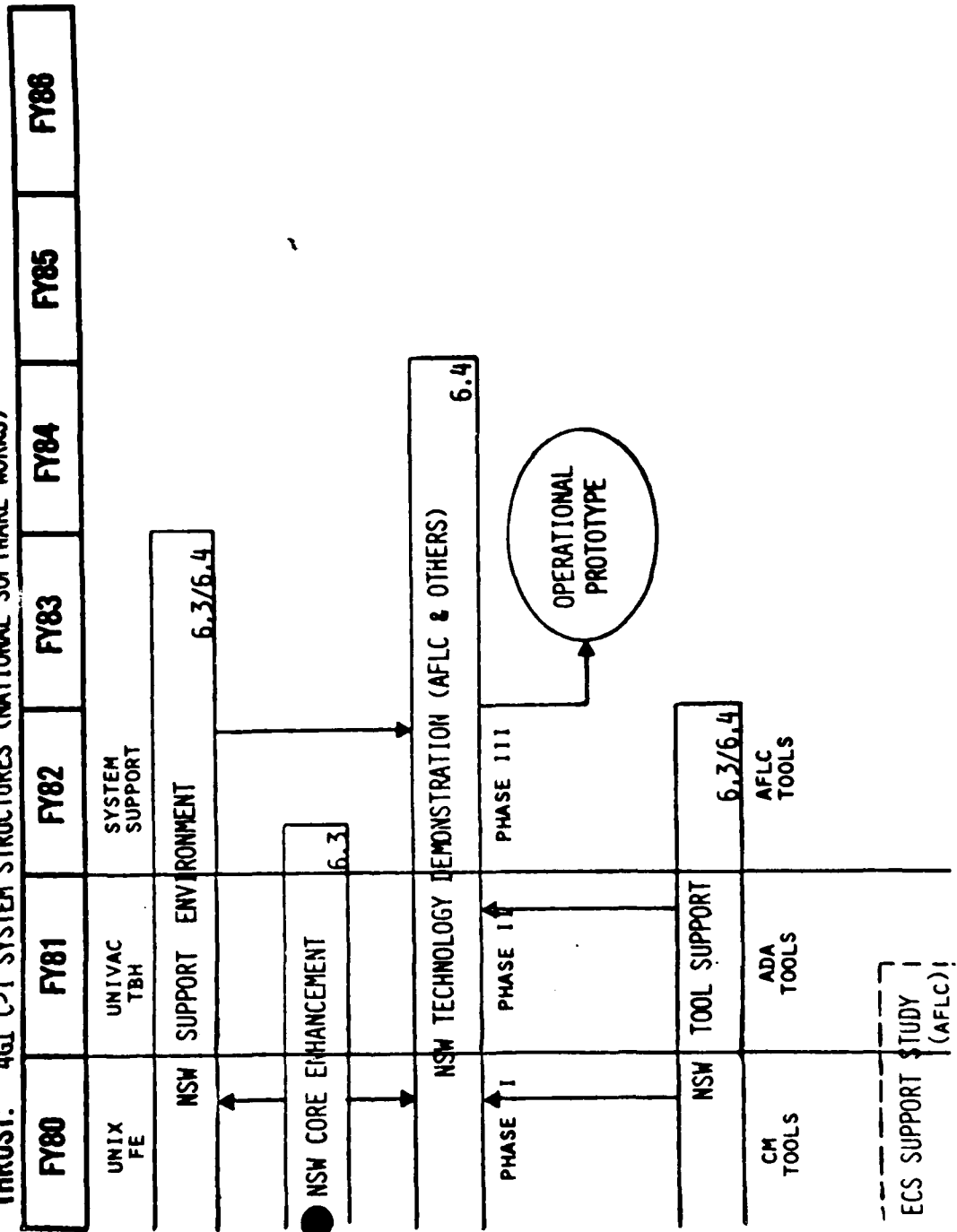
PAY-OFF: • MORE TIMELY AND COMPLETE DATABASE
• LOWER OVERHEAD IN DATA MAINTENANCE

NATIONAL SOFTWARE WORKS



RADC TP0 4 TECHNOLOGY

THRUST: 4G1 C31 SYSTEM STRUCTURES (NATIONAL SOFTWARE WORKS)



AD-A088 341

ROME AIR DEVELOPMENT CENTER GRIFFISS AFB NY
INDUSTRY LOOKS AT RADC - 1980. VOLUME III.(U)
1980

F/6 5/1

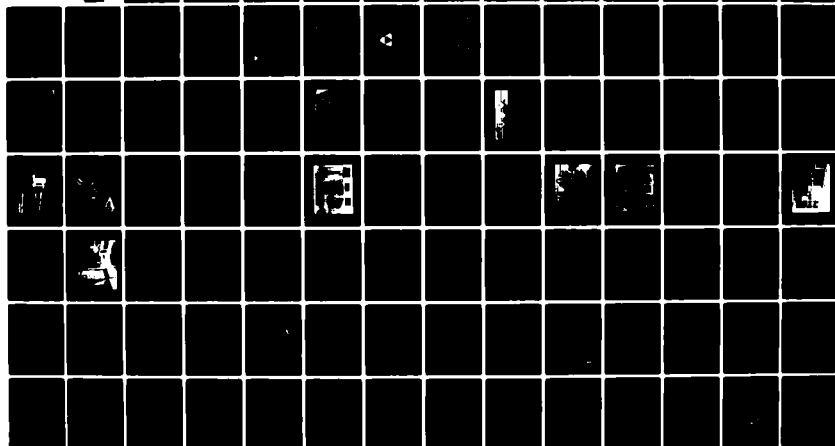
UNCLASSIFIED

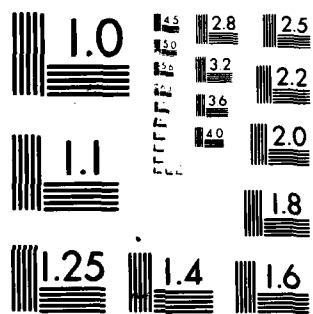
RADC-TR-80-195-VOL-3

NL

2 of 3

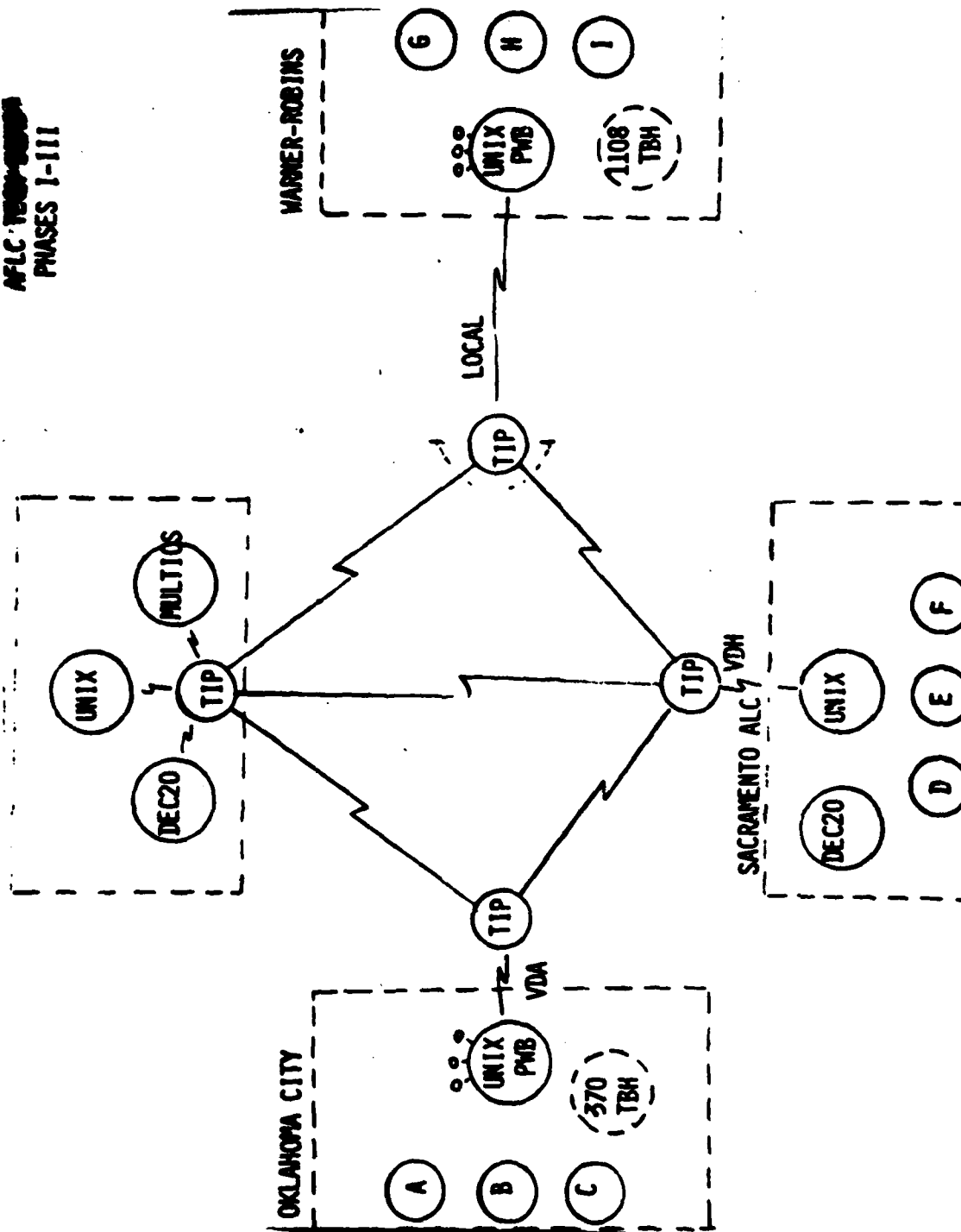
AD
A-088341





MICROCOPY RESOLUTION TEST CHART
NATIONAL BUREAU OF STANDARDS 1963-A

**AFLC TECH-SECURITY
PHASES I-III**



TPO/THRUST #TITLE: 46 INFORMATION PROCESSING

THRUST/SUB-THRUST/SUB-SUB-THRUST #TITLE: 461 C31 SYSTEM STRUCTURES

BLOCK TITLE: NSW TECHNOLOGY DEMONSTRATION

OBJECTIVE: THE OBJECTIVE OF THIS EFFORT IS TO CONDUCT AN NSW TECHNOLOGY DEMONSTRATION FOR THREE AIR LOGISTICS CENTERS (ALC) WITHIN THE AIR FORCE LOGISTICS COMMAND (AFLC).

TECHNICAL APPROACH: THE EFFORT WILL BE CONDUCTED IN THREE PHASES:

- o PHASE I - ESTABLISH WARNER ROBINS ALC AS AN ARPANET NODE
 - COMPLETE PLANNING FOR OTHER SITE AND SCENERIOS
- o PHASE II - ESTABLISH OKLAHOMA CITY ALC AND SACRAMENTO ALC AS HOST
 - INTRODUCE NSW
- o PHASE III - EXECUTE FOUR APPLICATIONS SCENERIOS

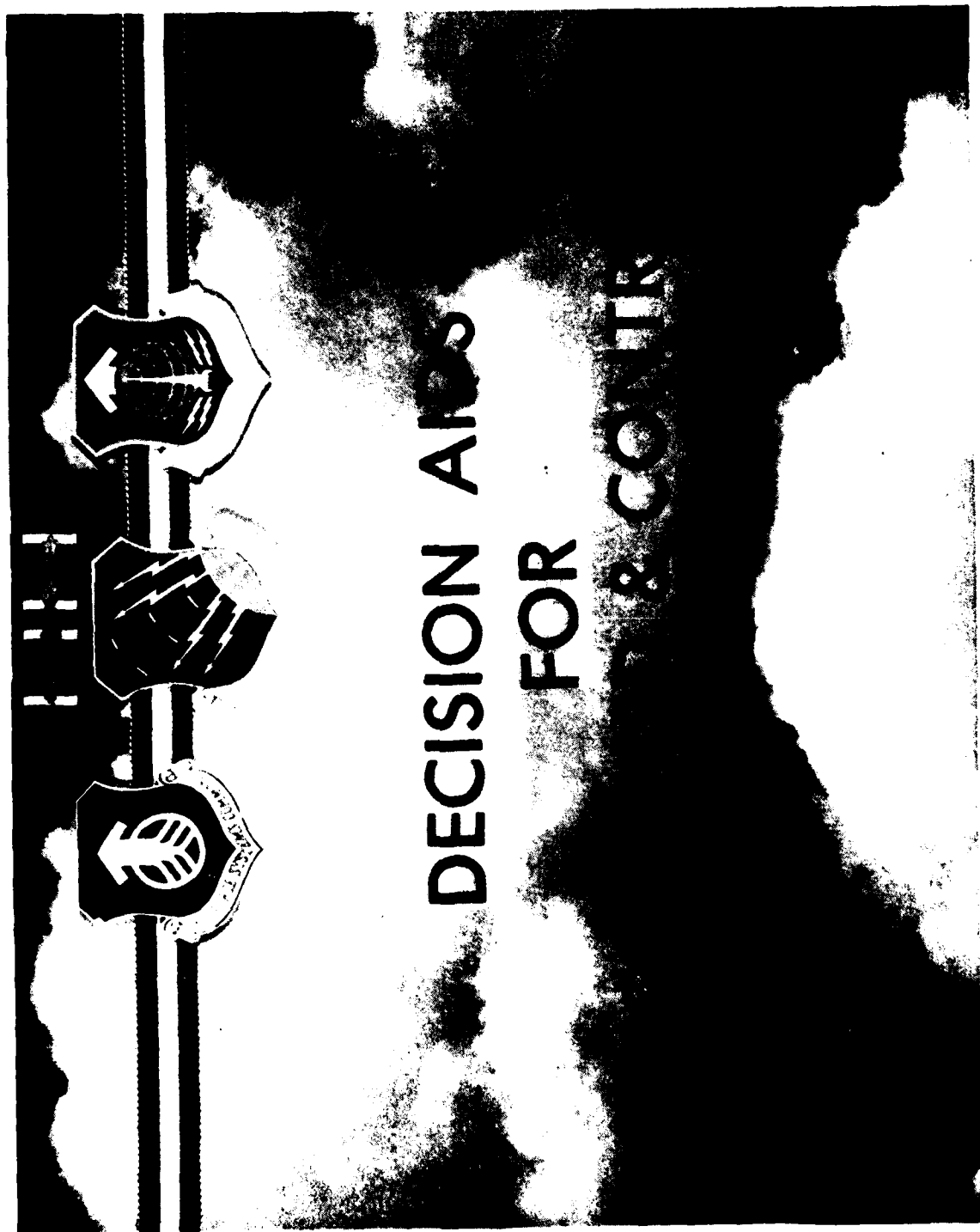
PAYOFF: MODERATE TO HIGH THROUGH:

- o SHARED RESOURCES
- o ACCESS TO NEW TOOLS
- o CONFIGURATION CONTROL OF LANGUAGES AND TOOLS

INDUSTRY LOOKS AT RADC 1980

TP0461/TP0462

<u>AREA</u>	<u>FOCAL POINT</u>	<u>SYMBOL/PHONE</u>
DISTRIBUTED OPERATING SYSTEMS	T. LAWRENCE	ISCP/7746
DISTRIBUTED DATABASES	R. METZGER	ISCP/2846
NATIONAL SOFTWARE WORKS	R. ROBINSON	ISCP/4916
TACTICAL APPLICATIONS	Y. SMITH	ISCP/2018
MODELING/SIMULATION	LI J. THOMAS	ISCP/7007
COMPUTER SECURITY	PAJ T. DARR	ISCP/4013



MAJOR GOALS OF C² DECISION AIDS

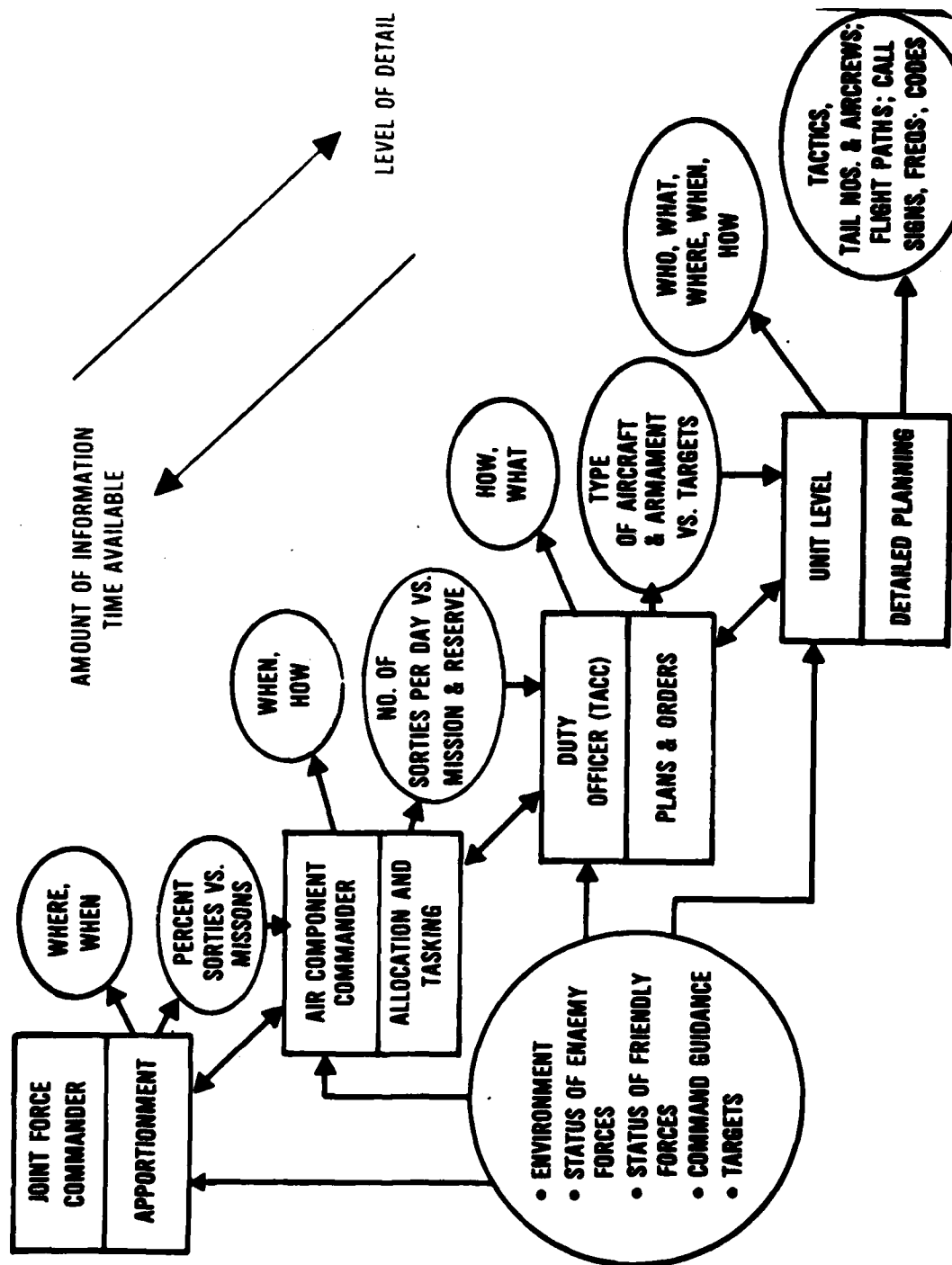
DEVELOP INTERACTIVE DECISION AIDS USING ADVANCED COMPUTER INFORMATION PROCESSING AND DISPLAY WHICH WILL ASSIST THE DECISION MAKER TO:

- **ASSESS WHAT WILL HAPPEN IN UNCERTAIN ENVIRONMENTS**
- **USE AND COMBINE INFORMATION**
- **APPLY INFERENCE, PREDICTION AND DIAGNOSIS**
- **EVALUATE WORTH OF OBJECTS**
- **WEIGH RISKS AGAINST BENEFITS**

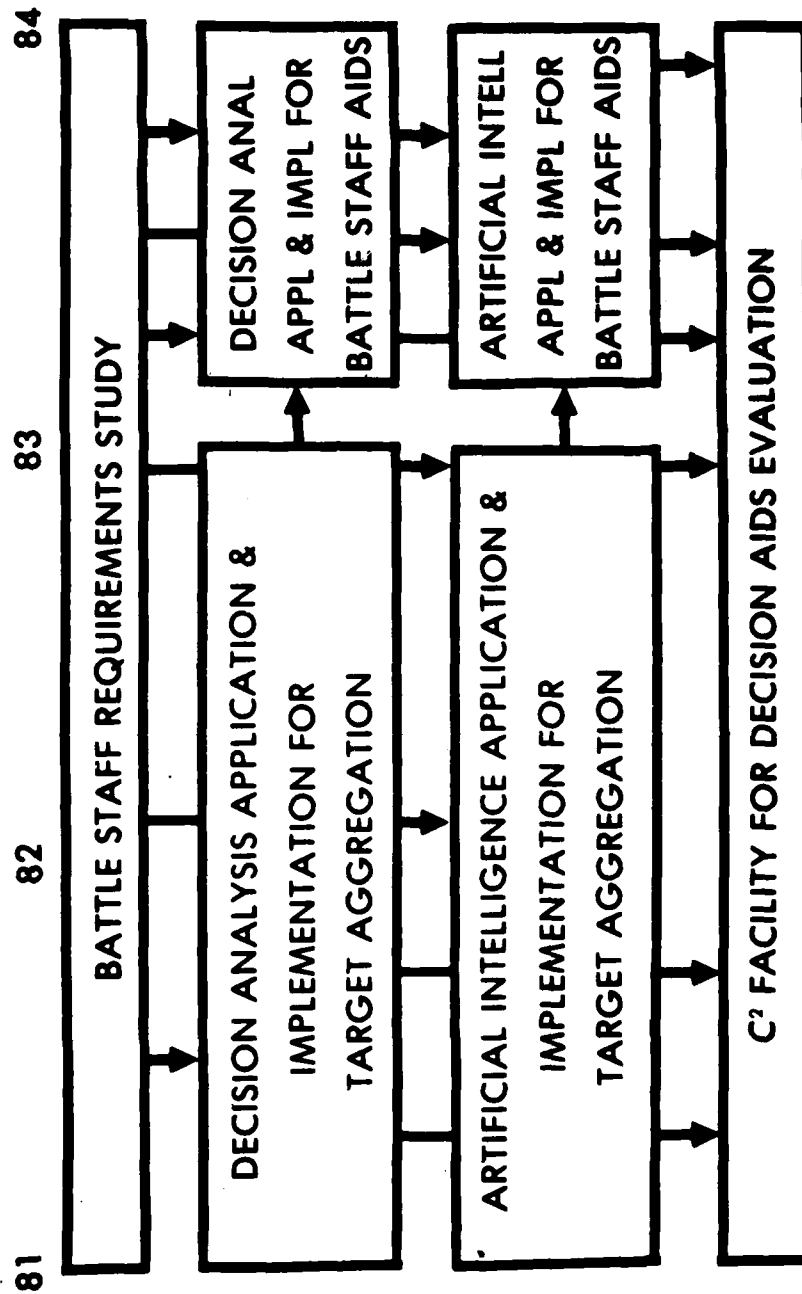
TECHNOLOGY BASE FOR C² DECISION-MAKING

- AUTOMATED DECISION AIDS
- KNOWLEDGE-BASED SYSTEMS
- NATURAL LANGUAGES
- MODELLING
- HUMAN PROCESSES IN DECISION-MAKING

LEVELS OF DECISION-MAKING



C² DECISION AIDS



STUDY OF BATTLE STAFF REQUIREMENTS FOR DECISION AIDS

DATA COLLECTION

- **INTERVIEWS WITH KEY STAFF PEOPLE**
- **DOCUMENTATION REVIEW**
- **OBSERVATIONS**

ANALYSIS

- **IDENTIFICATION OF DECISION-MAKING PROCESS**
- **CHARACTERIZATION OF DECISION-MAKING PROCESS**

EVALUATION

- **DETERMINATION OF OPPORTUNITIES FOR IMPROVEMENT**
- **DETERMINATION OF UTILITY OF DECISION AIDS**
- **RECOMMENDATION OF APPLICATION EFFORTS**

DECISION AIDS FOR TARGET AGGREGATION

STUDY & ANALYSIS OF FUNCTIONAL APPLICATIONS

APPLICATION & IMPLEMENTATION OF DECISION AIDS ON SELECTED FUNCTIONAL APPLICATIONS

FEASIBILITY DEMO & EVALUATION OF DECISION AID APPLICATIONS

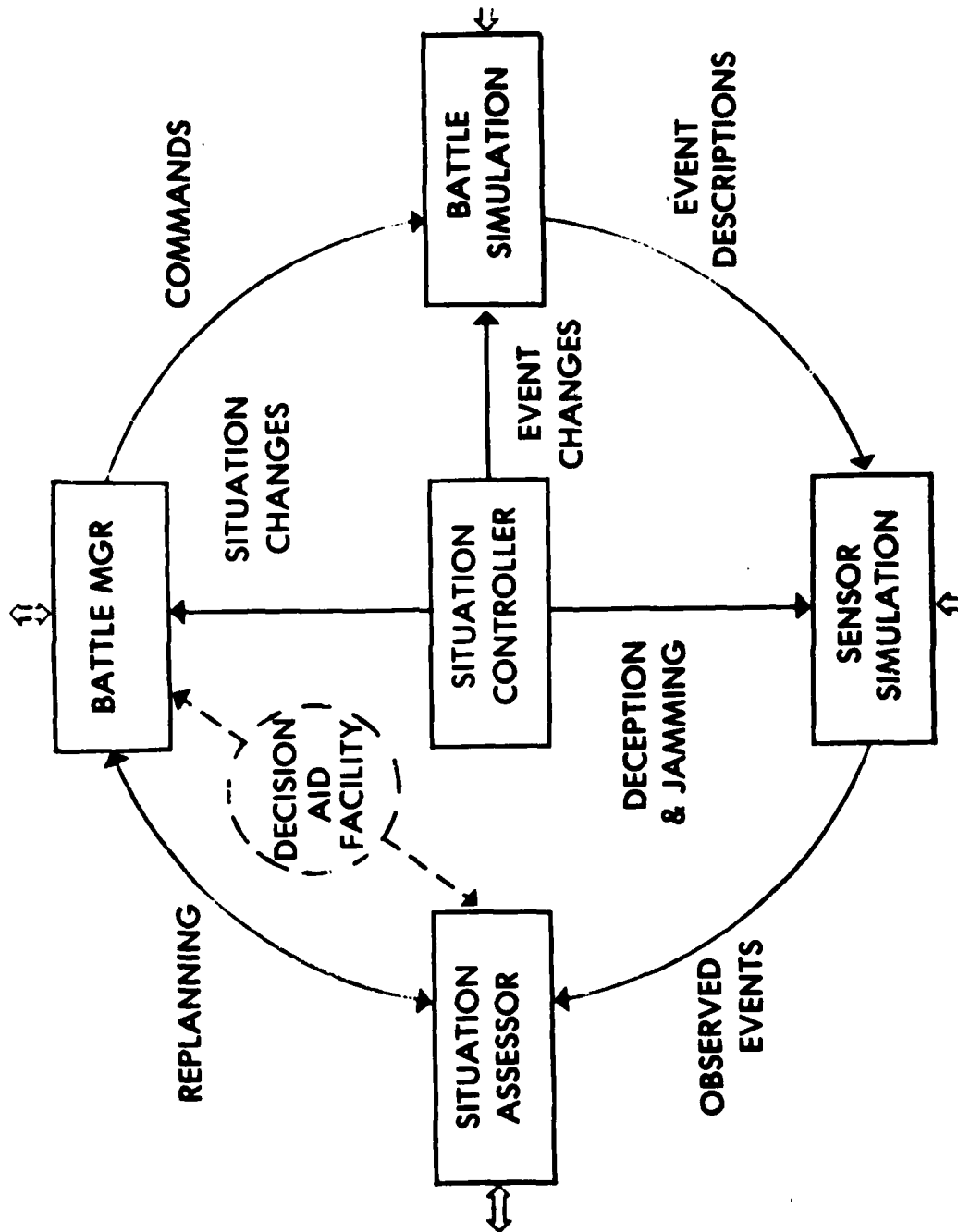
DECISION AIDS TECHNOLOGY

- **DECISION ANALYSIS**
- **ARTIFICIAL INTELLIGENCE**

INTERACT WITH OTHER CONTRACTORS

- **BATTLE STAFF REQUIREMENTS STUDY**
- **C³ FACILITY FOR DECISION AIDS**

TEST BED FUNCTIONS



TEST BED REQUIREMENTS

- TEST AND EVALUATE CONCEPTS
- DEMONSTRATE CAPABILITIES IN ENVIRONMENT COMPARABLE TO USERS
 - INTERACTION WITH USERS
 - TRANSFERABILITY
- PROVIDE REALISTIC ADP ENVIRONMENT TO CONTRACTORS
- MAINTAIN SOFTWARE CONFIGURATION CONTROL

PLANNED RADC PROGRAM, FY 81

APPLICATIONS OF DECISION AIDS TO TARGET AGGREGATION

STUDY OF BATTLE STAFF REQUIREMENTS FOR DECISION AIDS

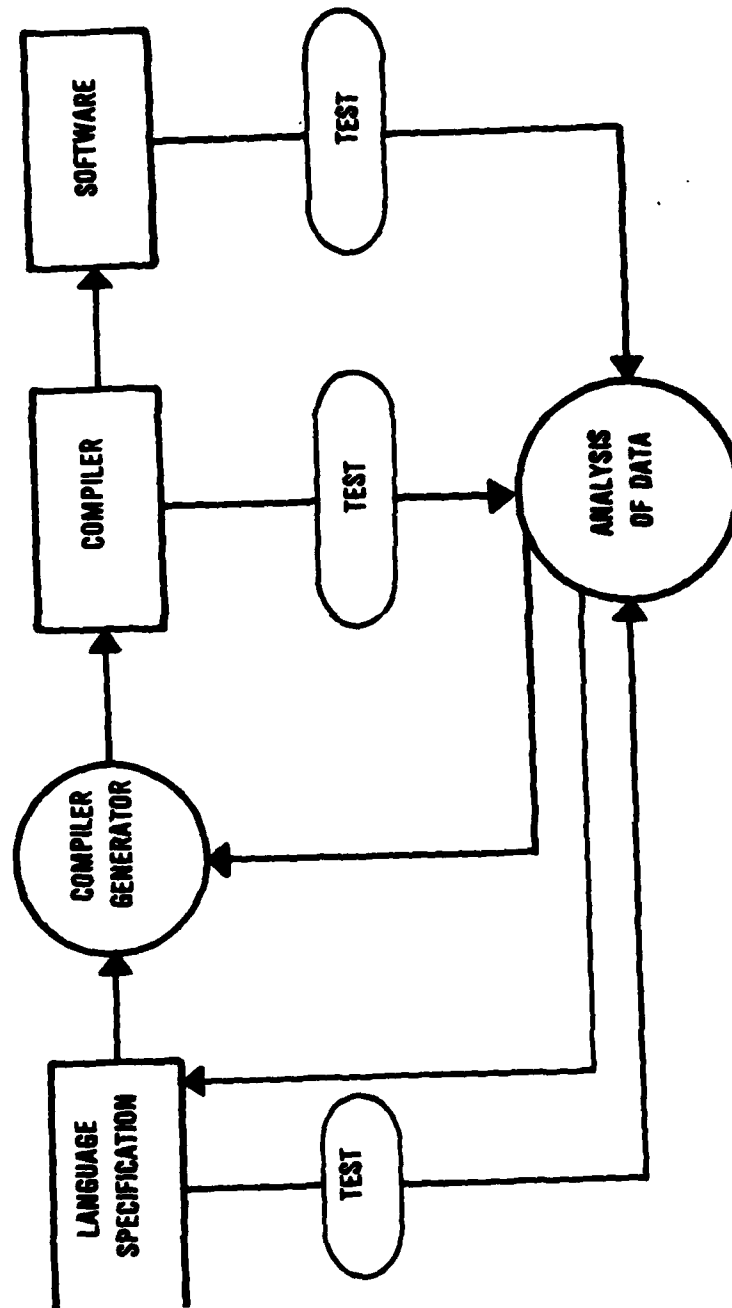
C² FACILITY FOR DECISION AIDS EVALUATION

INDUSTRY LOOKS AT RADC 1980

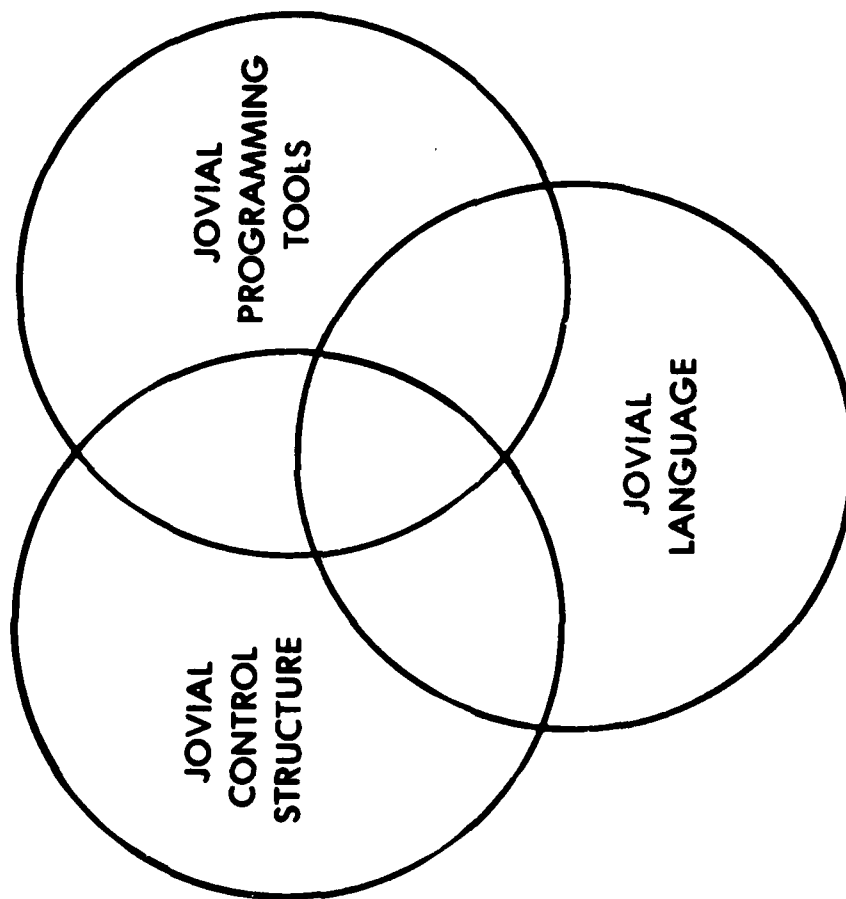
HIGHER ORDER LANGUAGES SUB-THRUST - TPO 464

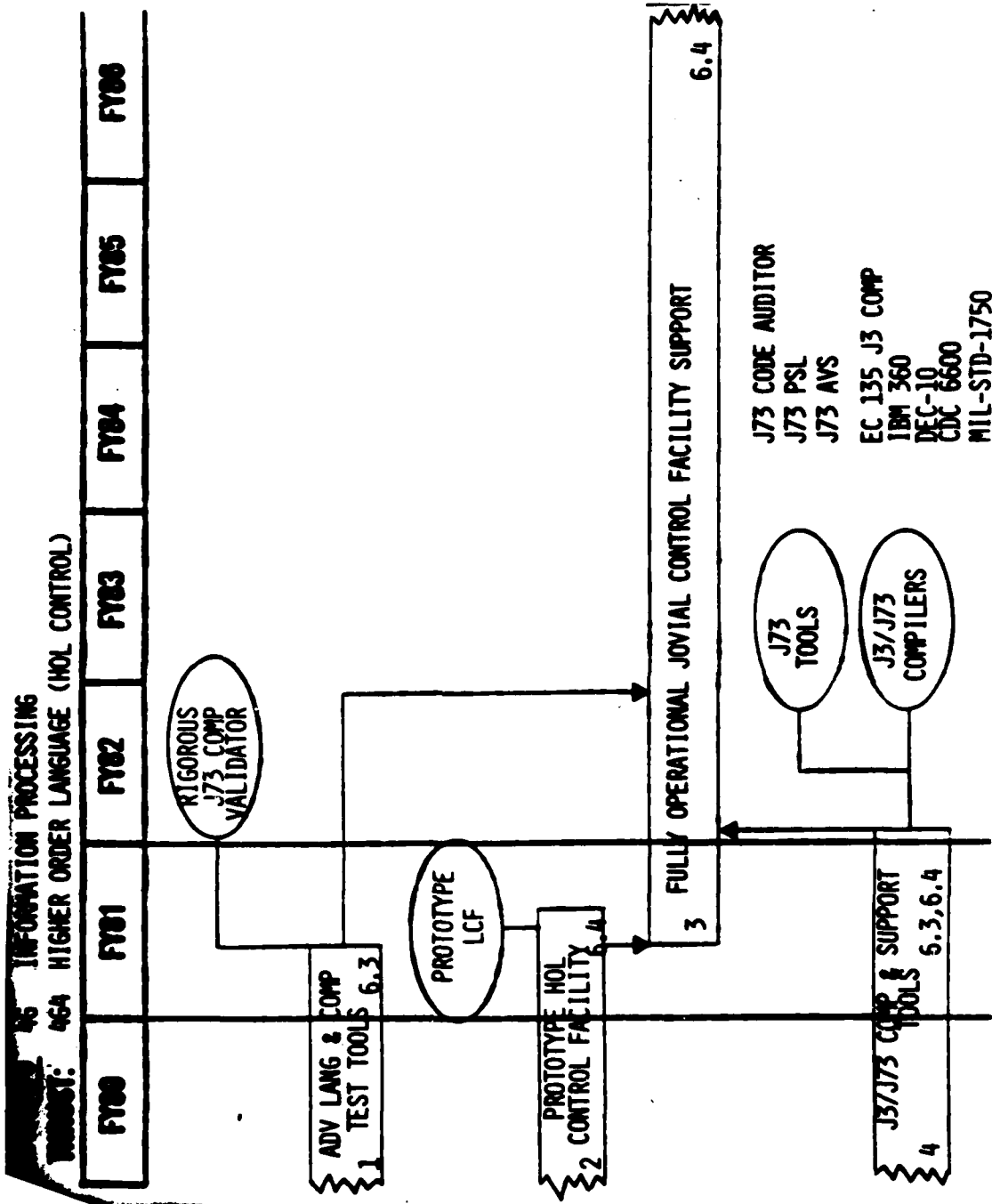
S. A. DIMITTO, JR.
SOFTWARE SCIENCES SECTION
ISIS/3851

SOFTWARE TOOLS & PROCEDURES FOR A CONTROL CENTER

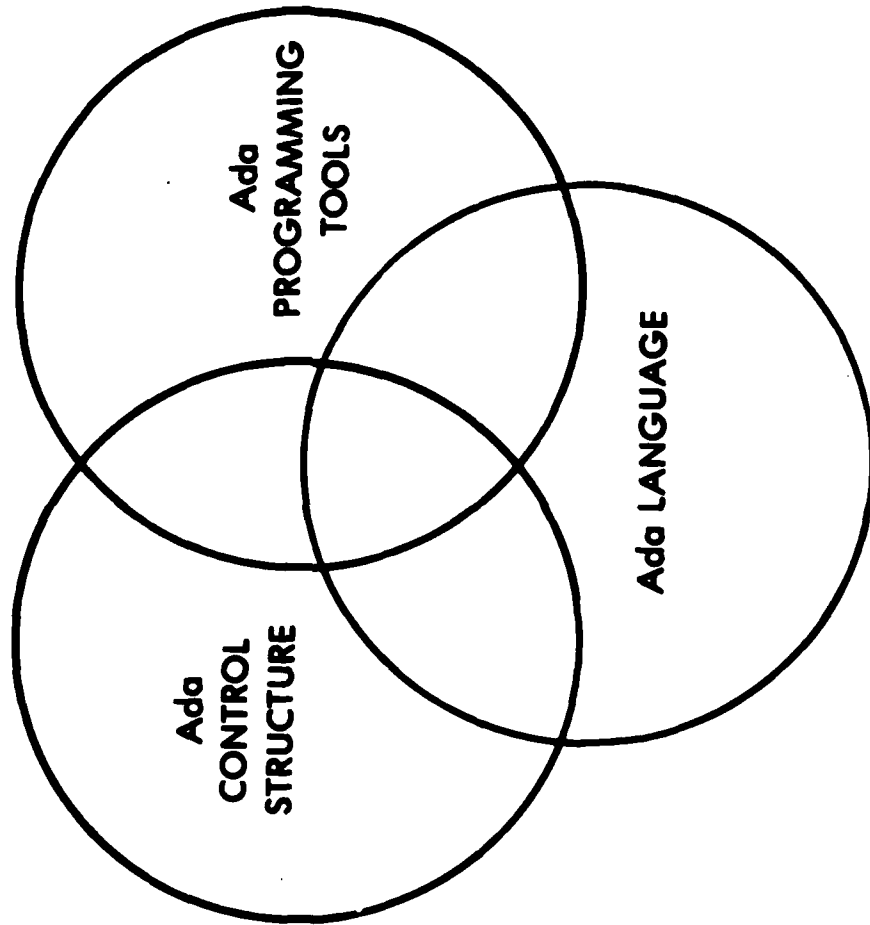


JOVIAL PROGRAMMING ENVIRONMENT

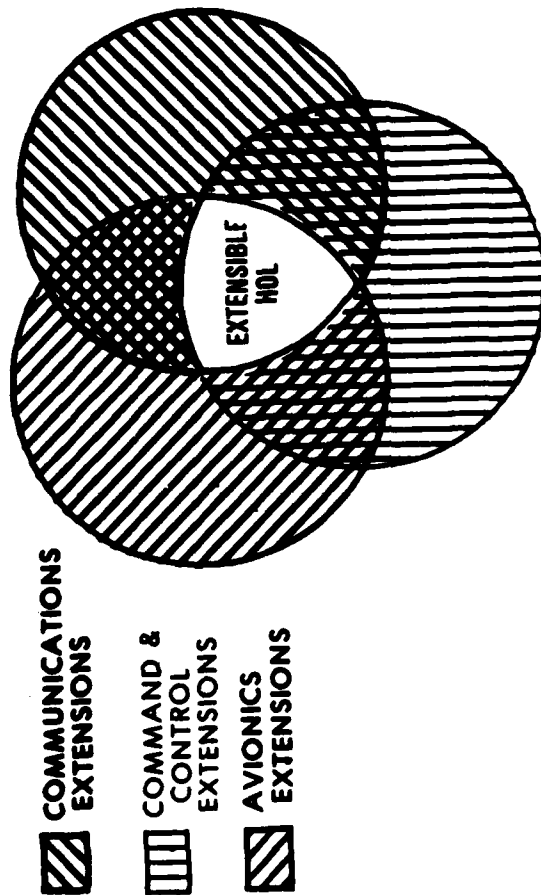




Ada (DOD-1) PROGRAMMING ENVIRONMENT



EXTENSIBLE HOL VS APPLICATIONS

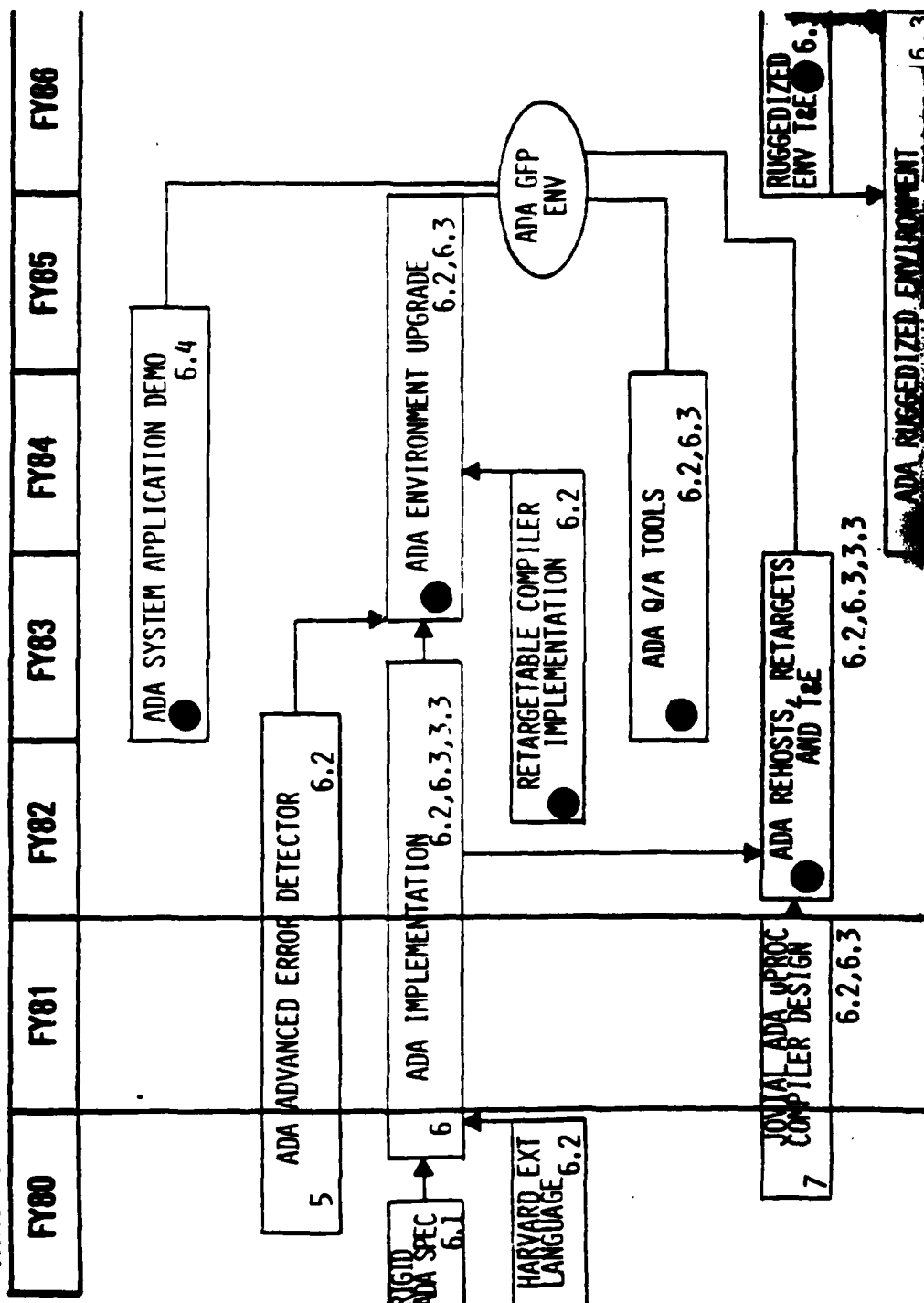


- SMALL "CORE" LANGUAGE - COMMON TO "ALL" APPLICATIONS
- "CORE" CAN BE EXTENDED TO MEET REQUIREMENTS —WITHOUT MODIFYING COMPILER
- EACH APPLICATION CAN HAVE ITS OWN UNIQUE EXTENSIONS —NOBODY PAYS FOR "UNUSED GENERALITY"
- AS NEW APPLICATIONS ARE ADDED, EACH GAINS FROM PREVIOUS INVESTMENTS
 - COMPILERS
 - SUPPORT TOOLS
 - TRAINING
 - APPLICATION DEPENDENT SOFTWARE LIBRARIES

CONTINUED

RADC IPO 4G INFORMATION PROCESSING

THRUST: 4G4 HIGHER ORDER LANGUAGE (ADA IMPLEMENTATION)



TPO/THRUST #/TITLE: 46 INFORMATION PROCESSING

SUB-THRUST #/TITLE: 464 HIGHER ORDER LANGUAGE (ADVANCED SOFTWARE DEVELOPMENT TECHNIQUES)

EFFORT BLOCK TITLE: ADA ENVIRONMENT UPGRADE

OBJECTIVE: UPGRADE QUALITY, CURRENCY, CAPABILITY OF THE ADA ENVIRONMENT

TECHNICAL APPROACH:

- . IMPLEMENT CORRECTIONS
- . IMPLEMENT LANGUAGE CHANGES
- . IMPLEMENT OPTIMIZATIONS
- . INTEGRATE ADVANCED ERROR DETECTOR

PAY OFF: COMPILER WILL CONFORM TO LATEST ADA SPEC, ENVIRONMENT ENHANCED

CONFIDENT #/TITLE: 4C INFORMATION PROCESSING

CONFIDENT #/TITLE: 4C4 HIGHER ORDER LANGUAGE (ADA IMPLEMENTATION)

CONFIDENT #/TITLE: FEINSTEIN COMPILER IMPLEMENTATION

OBJECTIVE: SEMI-AUTOMATICALLY GENERATE HIGH QUALITY ADA COMPILER CODE GENERATORS

TECHNICAL APPROACH: . WORK FROM COMPUTER DESCRIPTION LANGUAGE

. CAPITALIZE ON STD COMPILER FRONT-END

KEY OFF: REDUCED COST OF COMPILERS, ADA MORE READILY AVAILABLE

TPO/THRUST #/TITLE: 46 INFORMATION PROCESSING

SUB-THRUST #/TITLE: 464 HIGHER ORDER LANGUAGE (ADVANCED SOFTWARE DEVELOPMENT TECHNIQUES)

EFFORT BLOCK TITLE: ADA Q/A TOOLS

OBJECTIVE: DEVELOP SOPHISTICATED Q/A TOOLS FOR USE WITH ADA.

TECHNICAL APPROACH: . AUTOMATED VERIFICATION SYSTEM

. QUALITY METRICS MEASUREMENT

ADV. OPT: LOWER TEST COSTS, FEWER RESIDUAL ERRORS, FASTER DEVELOPMENT

TPO/THRUST #/TITLE: 46 INFORMATION PROCESSING
SUB-THRUST #/TITLE: 464 HIGHER ORDER LANGUAGE (ADA IMPLEMENTATION)
EFFORT BLOCK TITLE: ADA REHOST, RETARGETS, AND TEST AND EVALUATION
OBJECTIVE: FURTHER PREPARE AND CHECK OUT ADA ENVIRONMENT FOR GFE

TECHNICAL APPROACH: . REHOST/RETARGET ADA ENVIRONMENT
- DEC-10, CDC6600, 1750A, DIS
TEST ADA UNDER APPLICATIONS CONDITIONS
- AVIONICS, ARMAMENTS, COMMUNICATIONS

PAY OFF: ALLOWS EARLY REQUIRED USE OF ADA ON AIR FORCE CONTRACTS

TPO/THRUST #/TITLE: 46 INFORMATION PROCESSING

SUB-THRUST #/TITLE: 464 HIGHER ORDER LANGUAGE (ADVANCED SOFTWARE DEVELOPMENT TECHNIQUES)

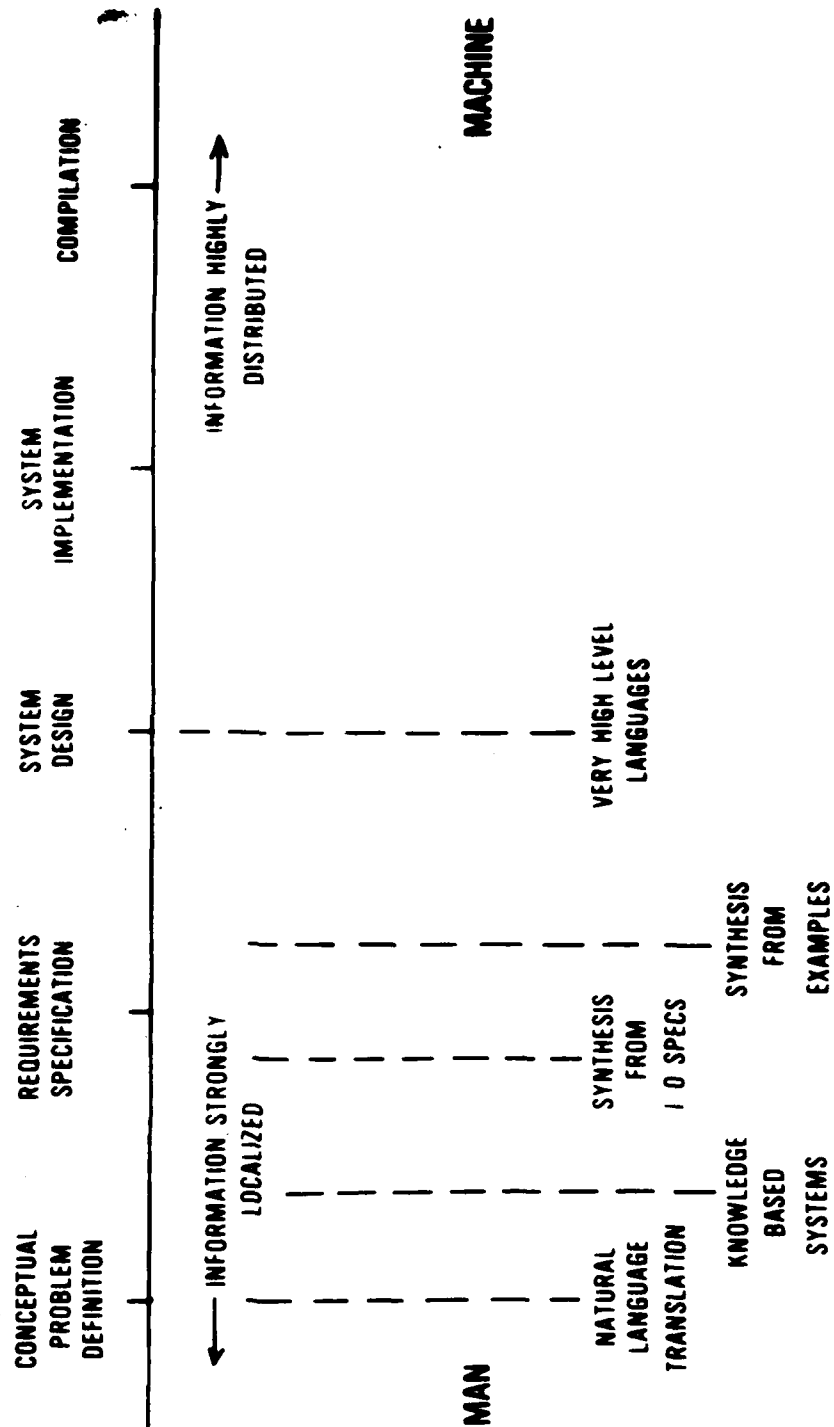
EFFORT BLOCK TITLE: ADA SYSTEM APPLICATION DEMO

OBJECTIVE: "MATURE" THE ADA INTEGRATED ENVIRONMENT

TECHNICAL APPROACH: . CANDIDATE SYSTEM APPLICATIONS PROVIDED BY PRODUCT DIVISIONS
. ENVIRONMENT IMPLEMENTED FOR SELECTED SYSTEM

PAY OFF: ADA PROVEN OUT, AVAILABLE ON MORE SYSTEMS

MAN-MACHINE INTERFACES

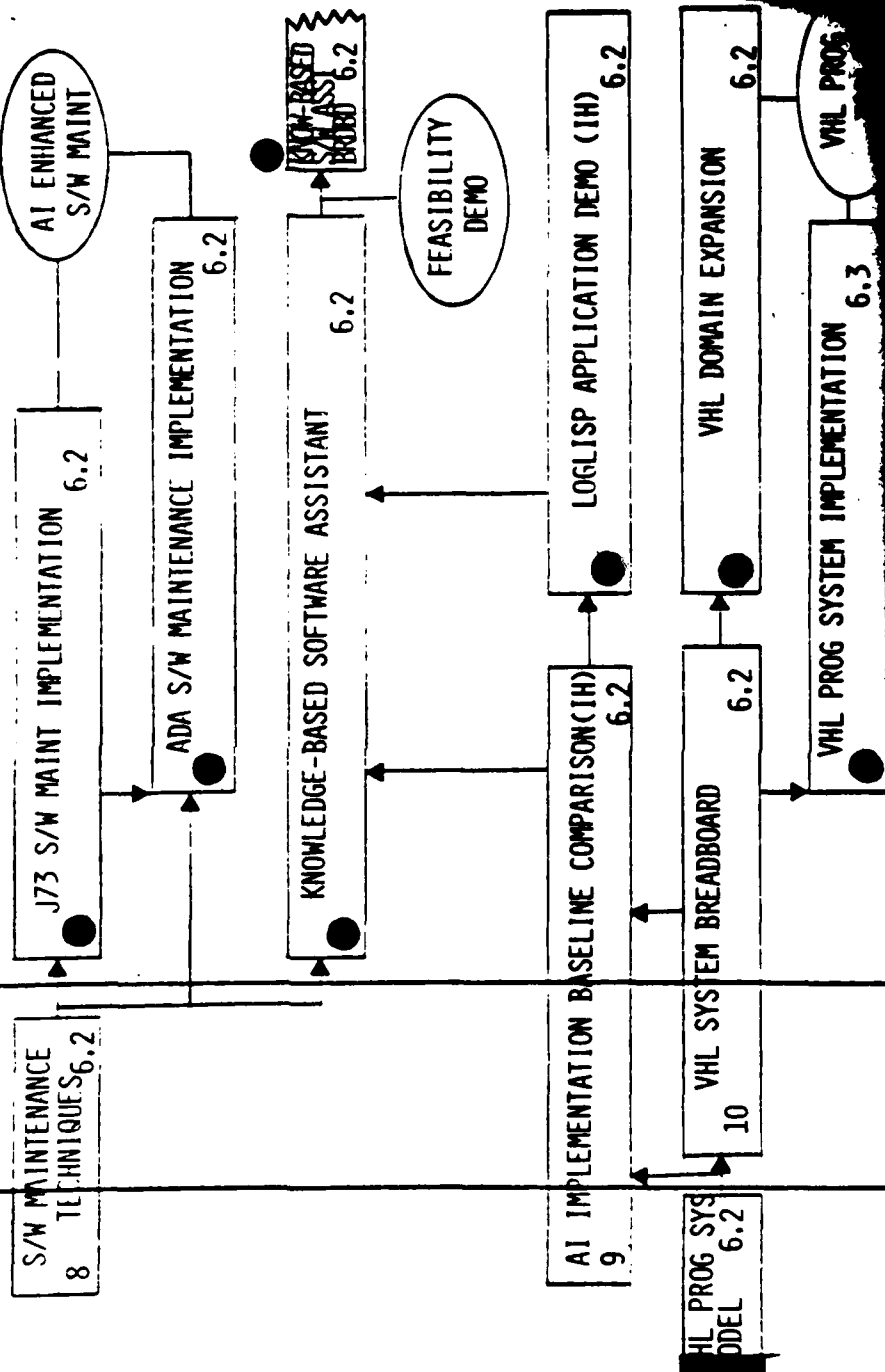


CONTINUED

4G INFORMATION PROCESSING

4G4 HIGHER ORDER LANGUAGE (ADVANCED SOFTWARE DEVELOPMENT TECHNIQUES)

FY80	FY81	FY82	FY83	FY84	FY85	FY86
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TFO/THRUST #/TITLE: 46 INFORMATION PROCESSING
SUB-THRUST #/TITLE: 464 HIGHER ORDER LANGUAGE (ADVANCED SOFTWARE DEVELOPMENT TECHNIQUES)
EFFORT BLOCK TITLE: J73 SOFTWARE MAINTENANCE IMPLEMENTATION

OBJECTIVE: IMPLEMENT TOOLS TO TAKE OVER TEDIOUS, ROUTINE "MAINTENANCE" TASKS

TECHNICAL APPROACH: . USE APPLICABLE ARTIFICIAL INTELLIGENCE TECHNOLOGY

- THEORY PROVING
- FLOW ANALYSIS
- COMPILER OPTIMIZATION

PAY OFF: REDUCED MAINTENANCE COSTS

TPO/THRUST #/TITLE:	46 <u>INFORMATION PROCESSING</u>
SUB-THRUST #/TITLE:	464 <u>HIGHER ORDER LANGUAGE (ADVANCED SOFTWARE DEVELOPMENT TECHNIQUES)</u>

SUB-THRUST #/TITLE: 464 HIGHER ORDER LANGUAGE (ADVANCED SOFTWARE DEVELOPMENT TECHNIQUES)

EFFORT BLOCK TITLE: ADA SOFTWARE MAINTENANCE IMPLEMENTATION

OBJECTIVE: IMPLEMENT "MAINTENANCE" TOOLS FOR ADA

TECHNICAL APPROACH:

- USE APPLICABLE ARTIFICIAL INTELLIGENCE TECHNOLOGY
- BUILD ON J73 SOFTWARE MAINTENANCE IMPLEMENTATION

PAY OFF: REDUCED MAINTENANCE COSTS

TPO/THRUST #/TITLE: 46 INFORMATION PROCESSING
SUB-THRUST #/TITLE: 4C4 HIGHER ORDER LANGUAGE (ADVANCED SOFTWARE DEVELOPMENT TECHNIQUES)
EFFORT BLOCK TITLE: KNOWLEDGE-BASED SOFTWARE ASSISTANT

OBJECTIVE: INTERACTIVE AID TO INTELLIGENTLY ASSIST ALL PHASES OF SOFTWARE LIFE CYCLE

TECHNICAL APPROACH: . FORMALIZE "EXPERT" KNOWLEDGE
. EMBODY "EXPERTISE" IN KNOWLEDGE-BASED SYSTEM
. ITERATIVELY REFINE

PAY OFF: LOWER LIFE CYCLE COSTS
. MINIMIZE INTEGRATION PROBLEMS
. CORPORATE MEMORY OF ALL LIFE CYCLE DECISIONS
. MINIMIZE IMPACT OF PERSONNEL CHANGES

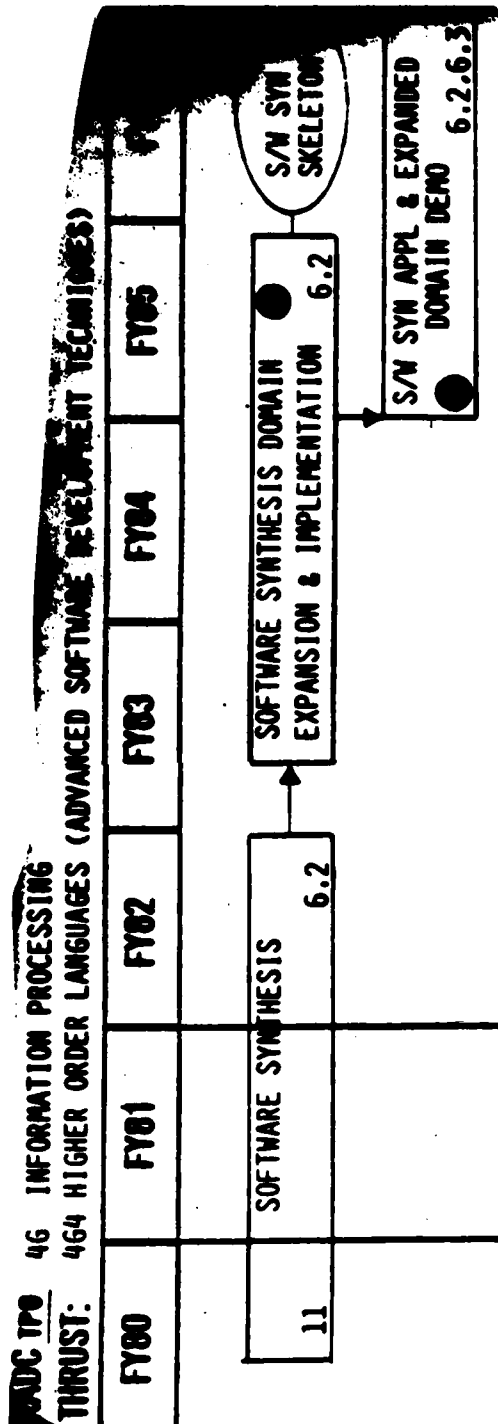
TPO/THRUST #/TITLE: 46 INFORMATION PROCESSING
SUB-THRUST #/TITLE: 464 HIGHER ORDER LANGUAGE (ADVANCED SOFTWARE DEVELOPMENT TECHNIQUES)
EFFORT BLOCK TITLE: VHL PROG SYSTEM IMPLEMENTATION

OBJECTIVE: HIGHER LEVEL COMMUNICATION LANGUAGE BETWEEN HUMAN AND COMPUTER

TECHNICAL APPROACH: . MODIFY AND EXTEND LOGLISP SYSTEM

- MORE POWERFUL KNOWLEDGE BASE
- INCREASE EFFICIENCY
- IMPROVE USER INTERFACE

PAY OFF: INCREASE PROGRAMMER PRODUCTIVITY IN ALL LIFE CYCLE PHASES



TPO/THRUST #/TITLE: 46 INFORMATION PROCESSING

SUB-THRUST #/TITLE: 464 HIGHER ORDER LANGUAGE (ADVANCED SOFTWARE DEVELOPMENT TECHNIQUES)

EFFORT BLOCK TITLE: SOFTWARE SYNTHESIS DOMAIN EXPANSION & IMPLEMENTATION

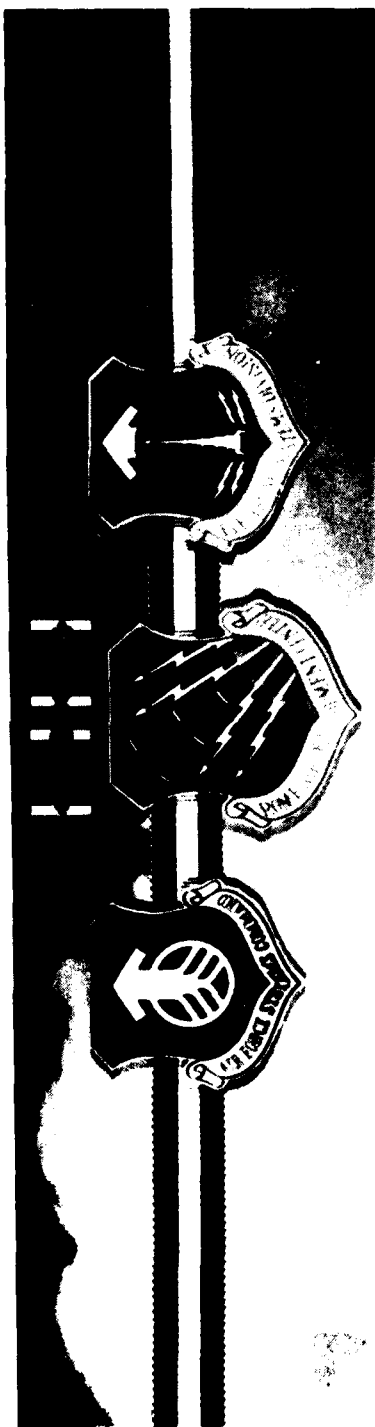
OBJECTIVE: GENERATE SOFTWARE FROM HIGH LEVEL SPECIFICATIONS

TECHNICAL APPROACH: . SYNTHESIS FROM I/O SPECIFICATIONS (MANNA & WALDINGER)
. SELECT MEANINGFUL APPLICATION DOMAIN

PAY OFF: REDUCE SCOPE OF LABOR INTENSIVE AND ERROR-PRONE ASPECTS OF SOFTWARE:
CODING, TESTING, MAINTENANCE

INDUSTRY LOOKS AT RADC 1980
HIGHER ORDER LANGUAGES
TP04G4

<u>AREA</u>	<u>PROGRAM MANAGER</u>	<u>SYMBOL/PHONE</u>
HOL CONTROL	RICHARD SLAVINSKI	ISIS/2748
ADA IMPLEMENTATION	DONALD ROBERTS	ISIS/4325
ADVANCED SOFTWARE DEVELOPMENT TECHNIQUES	DOUGLAS WHITE	ISIS/7010



WIDEBAND RECORDING

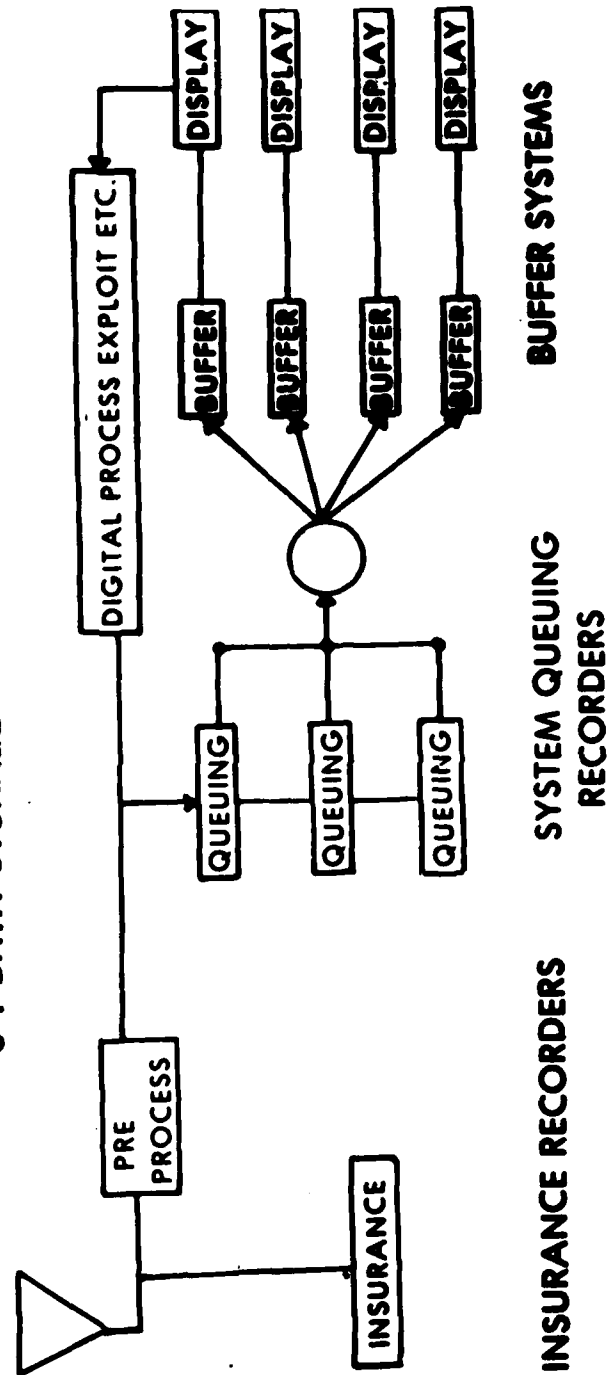
PRESENTED BY:

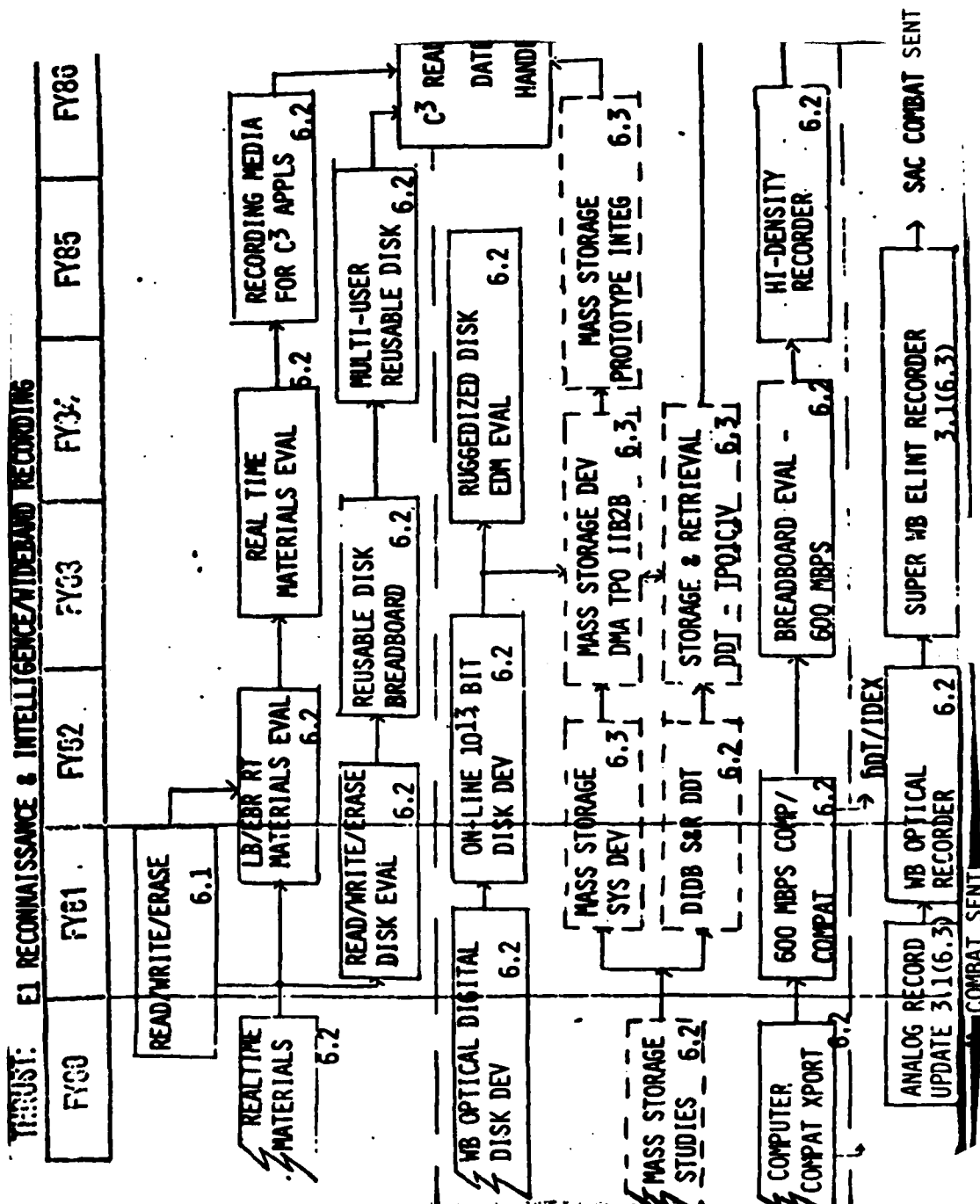
ALBERT A. JAMBERDINO

<u>TPO/THRUST:</u>	RECONNAISSANCE AND INTELLIGENCE
<u>SUB-THRUST:</u>	WIDEBAND RECORDING
<u>PROGRAM GOALS:</u>	TO DEVELOP THE NECESSARY ANALOG AND DIGITAL DATA RECORDING, TECHNOLOGIES TO INSURE THE PROPER COLLECTION, PROCESSING, STORAGE AND DISSEMINATION OF EXTREMELY HIGH DATA RATE INTELLIGENCE INFORMATION.
<u>TECHNICAL AREAS:</u>	MAGNETIC, ELECTRON BEAM, OPTICAL DISK, COVENTIONAL LASER, AND LASER HOLOGRAPHIC
<u>PROGRAMS</u>	<u>FUNDING</u> (IN THOUSANDS)
	<u>FY81 - FY86</u>
6 1	450
6 2	4000
6 3	6000

WIDE BAND RECORDING

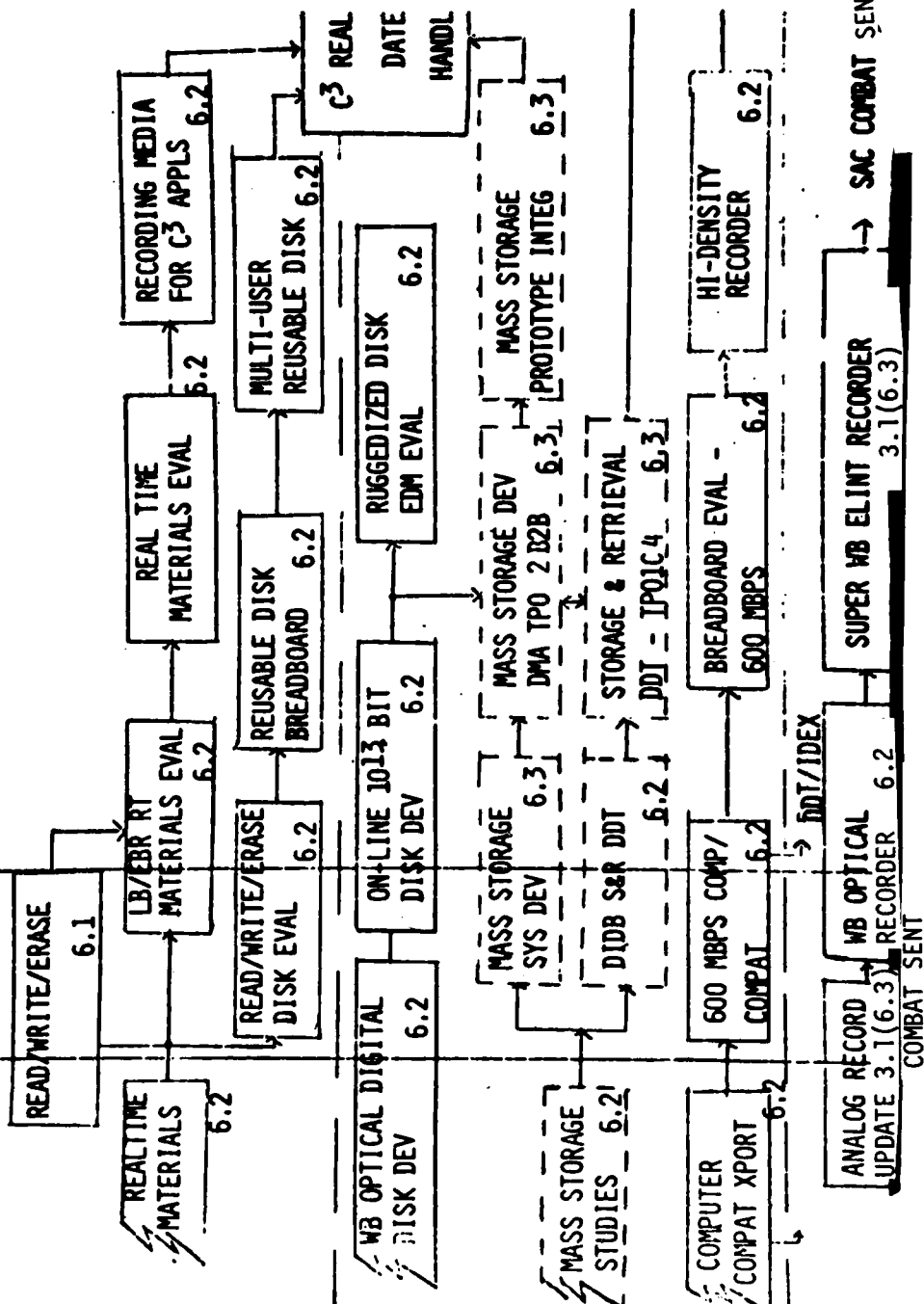
C³I DATA STORAGE & DISSEMINATION





THURST: 1/WIDEAND RECORDING

FY80	FY81	FY82	FY83	FY84	FY85	FY86
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TPO/THRUST:

RECONNAISSANCE AND INTELLIGENCE

SUB-THRUST:

WIDEBAND RECORDING

BLOCK TITLE:

LB AND EBR MATERIAL EVALUATION

OBJECTIVE:

PERFORM A QUANTITATIVE ANALYSIS OF REAL TIME RECORDING MATERIALS FOR APPLICATIONS SUCH AS IMAGE GENERATION (RECONNAISSANCE, TRANSMISSION AND DUPLICATION), WB OPTICAL DIGITAL DATA ACQUISITION AND HIGH DENSITY DIGITAL STORAGE AND RETRIEVAL.

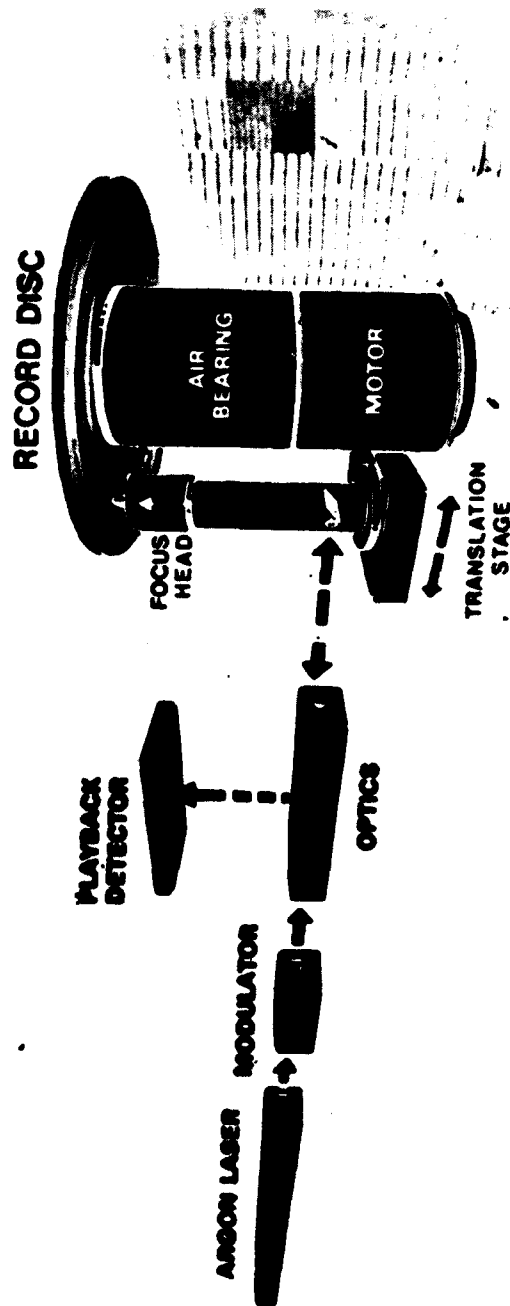
APPROACH:

DETERMINE ACHIEVABLE SPEED, RESOLVING POWER, SPECTRAL RESPONSE, GRANULARITY, ETC., OF CANDIDATE MATERIALS. FABRICATE EDM, EVALUATE MATERIAL.

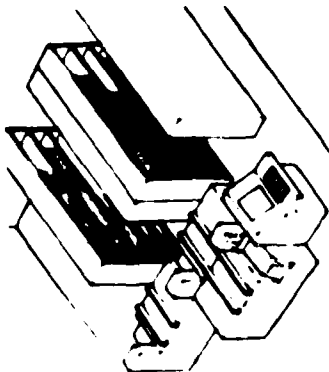
PAYOFF:

HIGH. FLEXIBLE RECORDING MATERIALS FOR REAL TIME OR NEAR REAL TIME IMAGE AND DIGITAL DATA EXPLOITATION AND DISSEMINATION.

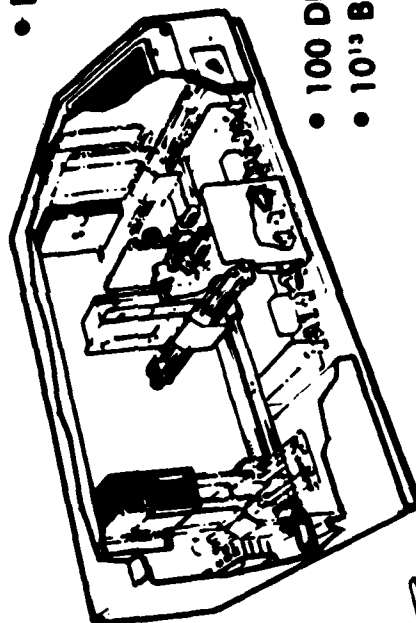
Optical Video Disc Recorder



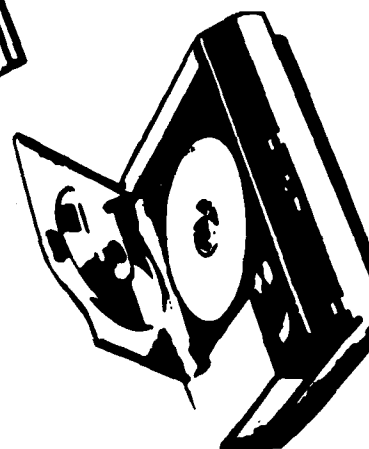
**DIGITAL STORAGE
ON/OFF LINE
OPTICAL DISK**



- GREATER THAN 10¹⁶ BITS
- LONG TERM STORAGE



- 100 DISKS
- 10¹³ BITS STORAGE



- 12 INCH DISK
- 10¹¹ BITS STORAGE

<u>TPO/THRUST:</u>	RECONNAISSANCE AND INTELLIGENCE
<u>SUB-THRUST:</u>	WIDEBAND RECORDING
<u>BLOCK TITLE:</u>	READ/WRITE/ERASE DISK
<u>OBJECTIVE:</u>	TO DETERMINE FEASIBILITY, LIMITATIONS AND TRADE OFFS OF APPLYING READ/WRITE/ERASE MATERIALS IN OPTICAL DIGITAL DISK CONFIGURATIONS.
<u>APPROACH:</u>	PERFORM A QUANTITATIVE ANALYSIS OF ACHIEVABLE DATA RATE, BIT ERROR RATE, PACKING DENSITY, NUMBER OF REUSE CYCLES, ETC., AS APPLIED TO HIGH DENSITY, DIGITAL EXPLOITATION SCENARIOS.
<u>PAY OFF:</u>	HIGH. EXTREMELY FLEXIBLE DIGITAL DISK FOR REAL TIME HIGH DATA RATE, HIGH VOLUME DIGITAL EXPLOITATION.

TPO/THRUST: RECONNAISSANCE AND INTELLIGENCE

SUB-THRUST: WIDEBAND RECORDING

BLOCK TITLE: REUSABLE DISK BREADBOARD

OBJECTIVE: TO DESIGN, DEVELOP AND EXPERIMENTALLY EVALUATE EXPLORATORY DEVELOPMENT
MODEL OF A ERASABLE/REUSABLE DIGITAL OPTICAL DISK.

APPROACH: CANDIDATE MATERIALS FROM THE ERASE/REUSE INVESTIGATIONS WILL BE
EVALUATED AS POTENTIALS IN OPTICAL DISK CONFIGURATIONS.

PAYOFF: HIGH. EXTREMELY FLEXIBLE DIGITAL DISK FOR REAL TIME EXPLOITATION
OF HIGH RESOLUTION DIGITAL IMAGERY, HIGH DATA RATE INTELLIGENCE
DATA, ETC.

TPO/THRUST: RECONNAISSANCE AND INTELLIGENCE

SUB-THRUST: WIDEBAND RECORDING

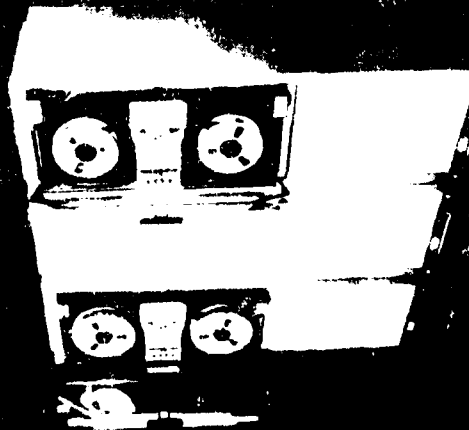
BLOCK TITLE: ON-LINE 10¹³ BIT DISK DEVELOPMENT

OBJECTIVE: DESIGN, DEVELOP AND EXPERIMENTALLY EVALUATE OPTICAL DIGITAL DISK TECHNOLOGY IN A "JUKE BOX" CONFIGURATION FOR MASS STORAGE AND RETRIEVAL APPLICATIONS.

APPROACH: IMPLEMENT 10¹³ "JUKE BOX" TO DETERMINE FEASIBILITY, LIMITATIONS AND ULTIMATE CAPABILITIES.

PAYOFF: HIGH. EXTREMELY FLEXIBLE DATA BASE MANAGEMENT CONCEPT TO HANDLE LARGE DATA BASES, WHERE FAST ACCESS IS REQUIRED.

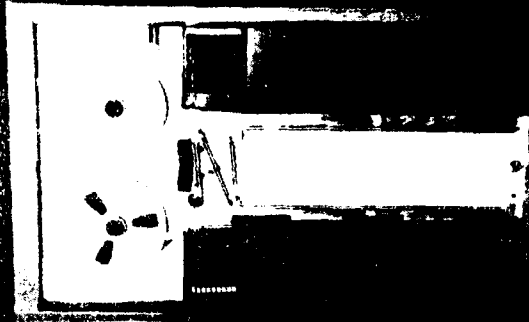
RADC WIDEBAND DIGITAL RECORDING



1976
240 Mbps
2 INCH



1977
300 Mbps



1979
400 Mbps
COMPUTER
COMPATIBLE

TPO/THRUST:

RECONNAISSANCE AND INTELLIGENCE

SUB-THRUST:

WIDEBAND RECORDING

BLOCK TITLE:

600 MEGABIT PER SECOND COMPUTER COMPATIBLE TAPE RECORDER

OBJECTIVE:

DESIGN, DEVELOP AND DEMONSTRATE AN EXPLORATORY DEVELOPMENT MODEL
600 MBPS, AND BEYOND COMPUTER COMPATIBLE TAPE DRIVE.

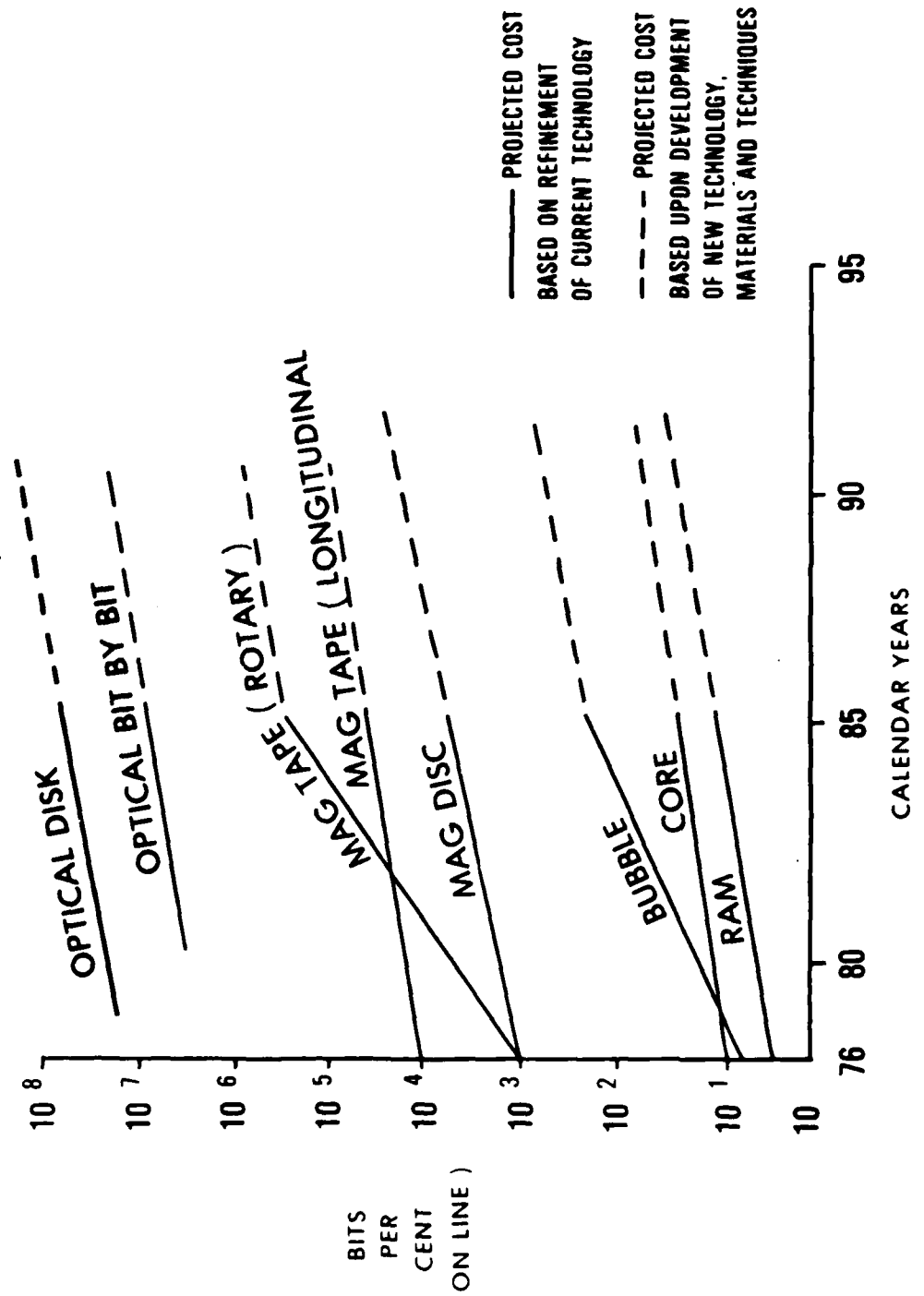
APPROACH:

IMPROVE PACKING DENSITY AND TAPE DRIVE MECHANICAL CHARACTERISTICS
TO PROVIDE REQUIRED RECORD/REPRODUCE RATES, CONTROLLED SEARCH AND
FAST STOP/START CHARACTERISTICS. DEVELOP AUTOMATED ACCESSING
CAPABILITY TO ACCURATELY LOCATE DATA ON TAPE.

PAYOFF:

HIGH. OFFERS ORDER OF MAGNITUDE IMPROVEMENT OVER THE STORAGE AND
ACCESSING CAPABILITIES OF CONVENTIONAL COMPUTER COMPATIBLE TAPE
(CCT) UNITS.

HI DENSITY RECORDING PROJECTED STORAGE COSTS (BITS PER CENT)



KEY CONTACT POINTS

ALBERT A. JAMBERDINO	RADC/IRAP	330-4581
JACK D. PETRUZZELLI	RADC/IRAP	330-4581
LT. JAMES L. HANGER	RADC/IRAP	330-4581
WALTER S. CZYZYCKI	RADC/IRAP	330-4581
WILLIAM C. ZIESENITZ	RADC/IRAP	330-4581

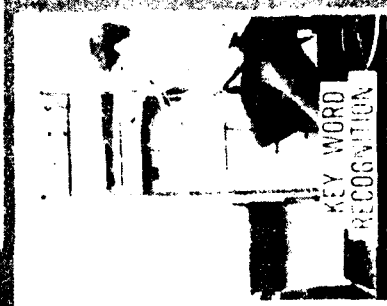
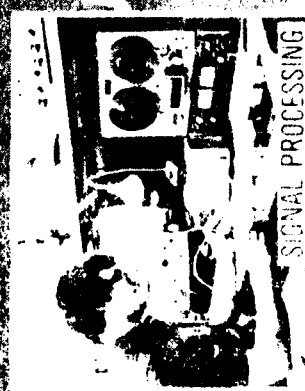


SPEECH PROCESSING

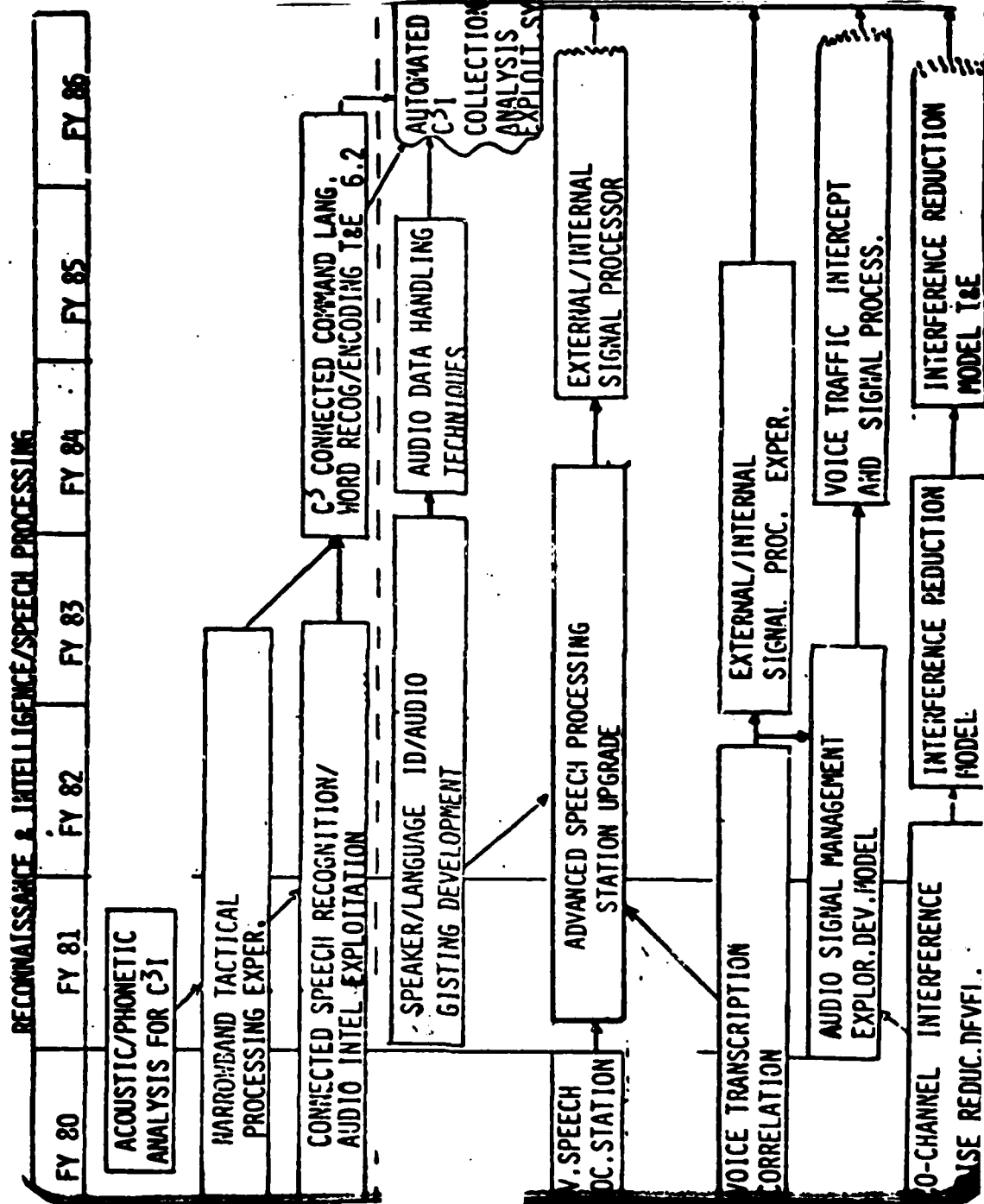
ADVANCED/EXPLORATORY DEVELOPMENT OVERVIEW

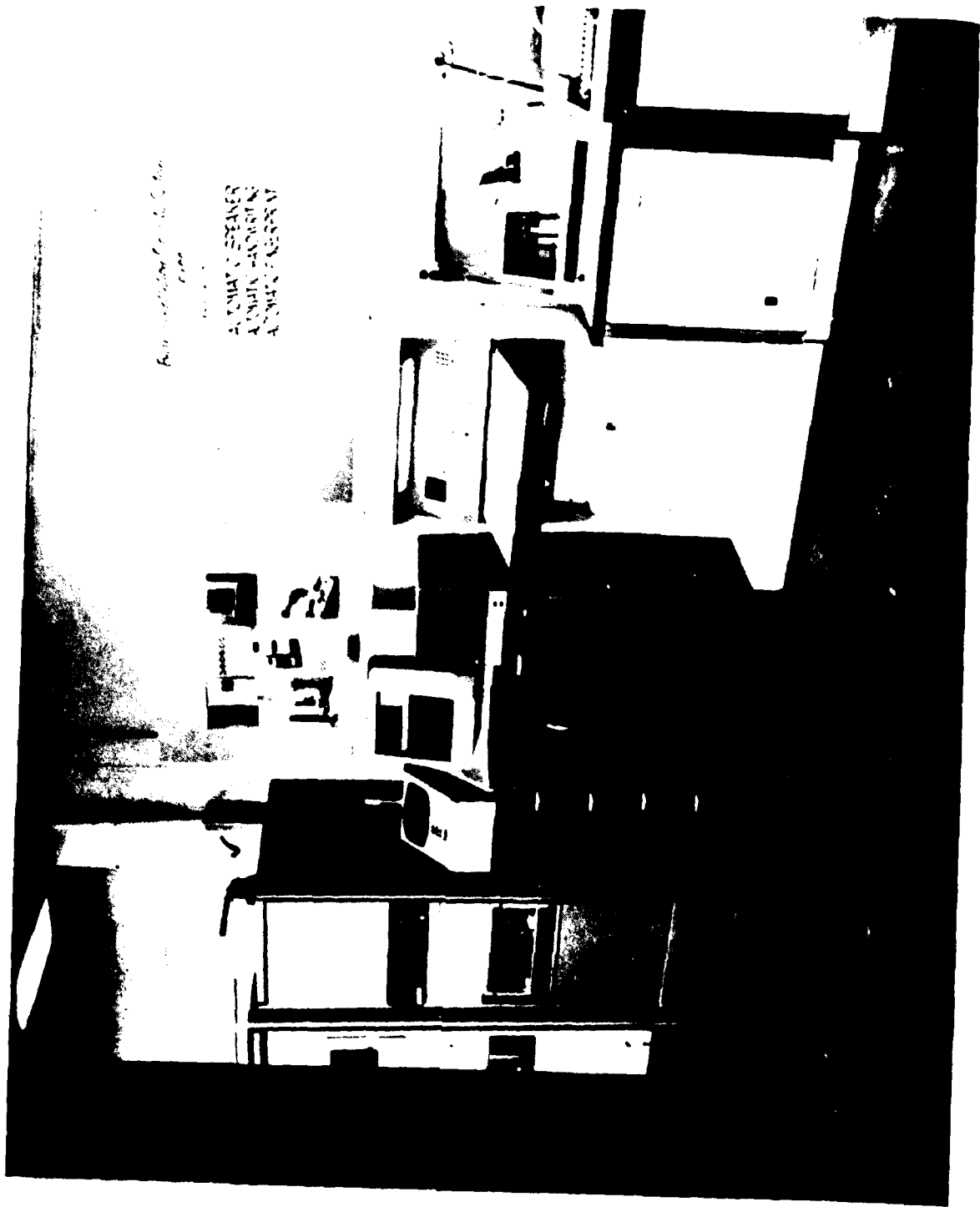
**PRESENTED BY:
DR. BRUNO BEEK**

RADC SPEECH / AUDIO PROCESSING TECHNOLOGY



TPO/THRUST:	RECONNAISSANCE & INTELLIGENCE	
SUB-THRUST:	SPEECH PROCESSING	
PROGRAM GOALS:	TO DEVELOP AND IMPLEMENT AUTOMATED TECHNIQUES FOR VOICE DATA ENTRY NARROWBAND COMMUNICATIONS, AND EXPLOITATION OF INTERCEPT VOICE DATA.	
TECHNICAL AREAS:	AUDIO/SPEECH EXPLOITATION COMINT AUDIO TRANSCRIPTION AUDIO ENHANCEMENT ADVANCED SPEECH PROCESSING	
PROGRAMS	FY 81-86 FUNDING (IN THOUSANDS)	
6.1		450
6.2		6,000
6.3		2,000





TPO/THRUST:

SUB-THRUST:

BLOCK TITLE:

OBJECTIVE:

TECHNICAL APPROACH:

PAYOFF:

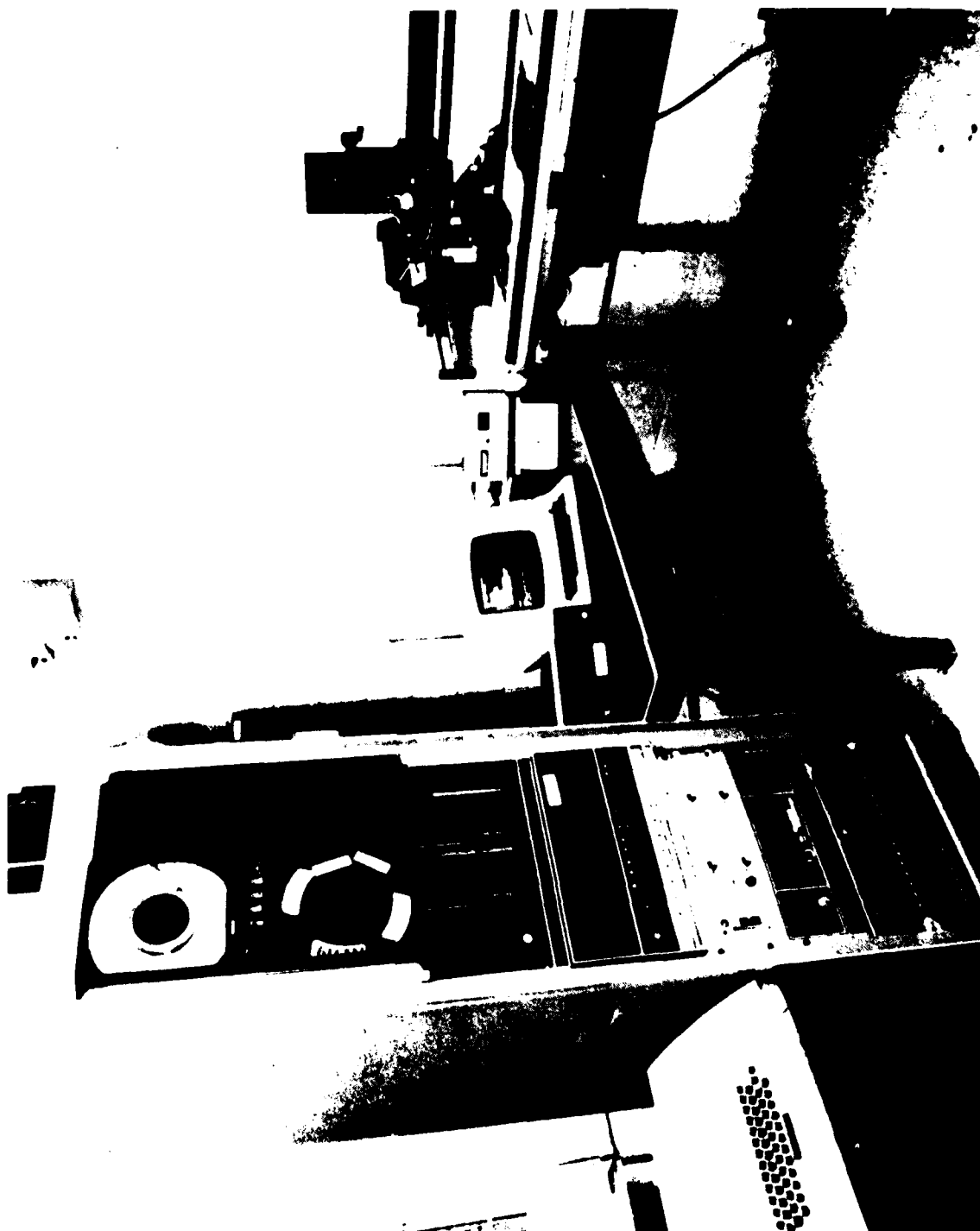
**RECONNAISSANCE & INTELLIGENCE
SPEECH PROCESSING**

NARROWBAND TACTICAL PROCESSING EXPERIMENT

**DEVELOP A SPEECH PROCESSING TECHNOLOGY CAPABLE OF TRANSMITTING/
RECEIVING SPEECH SIGNALS AT DATA RATES OF LESS THAN 200 BITS/
SECOND.**

**INVESTIGATE AUTOMATIC PHONETIC ANALYSIS/SYNTHESIS TECHNIQUES
WHICH CAN PROVIDE INTELLIGIBLE, NATURAL, AND HIGH QUALITY
SPEECH.**

**REDUCE BIT RATE IN TACTICAL COMMUNICATION LINKS AND IMPROVED
RESISTANCE TO JAMMING.**



TPO/THRUST:

RECONNAISSANCE & INTELLIGENCE

SUB-THRUST:

SPEECH PROCESSING

BLOCK TITLE:

CONNECTED SPEECH RECOGNITION & AUDIO INTEL EXPLOITATION

OBJECTIVES:

DEVELOP A HIGHLY RELIABLE CONNECTED WORD RECOGNITION TECHNIQUE
FOR C³I APPLICATIONS.

ANALYSIS OF ACOUSTIC INTEL SIGNALS.

TECHNICAL APPROACH:

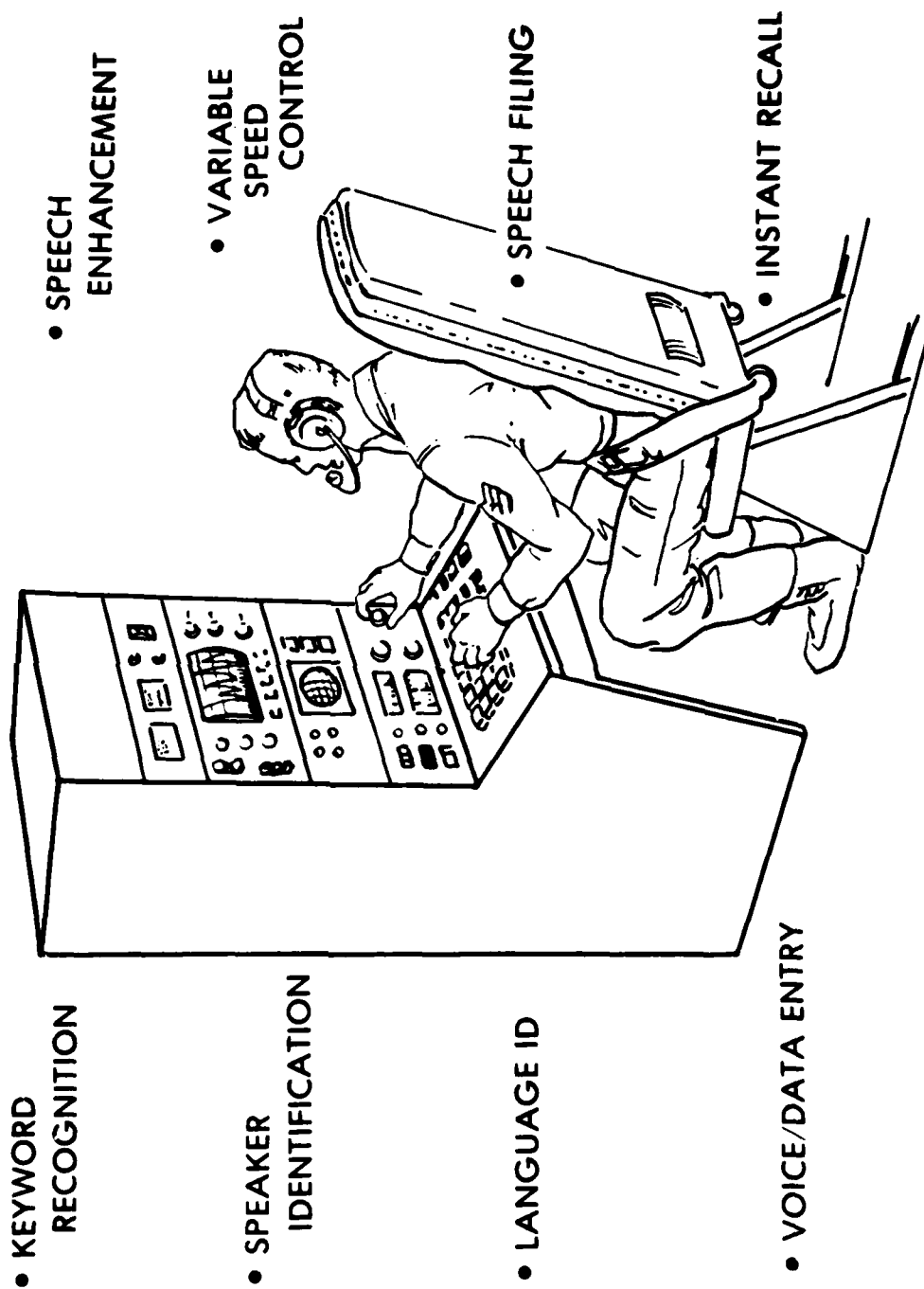
FABRICATE, TEST, AND EVALUATE A BREADBOARD MODEL OF A SOLID STATE
LIMITED CONNECTED WORD RECOGNITION SYSTEM.

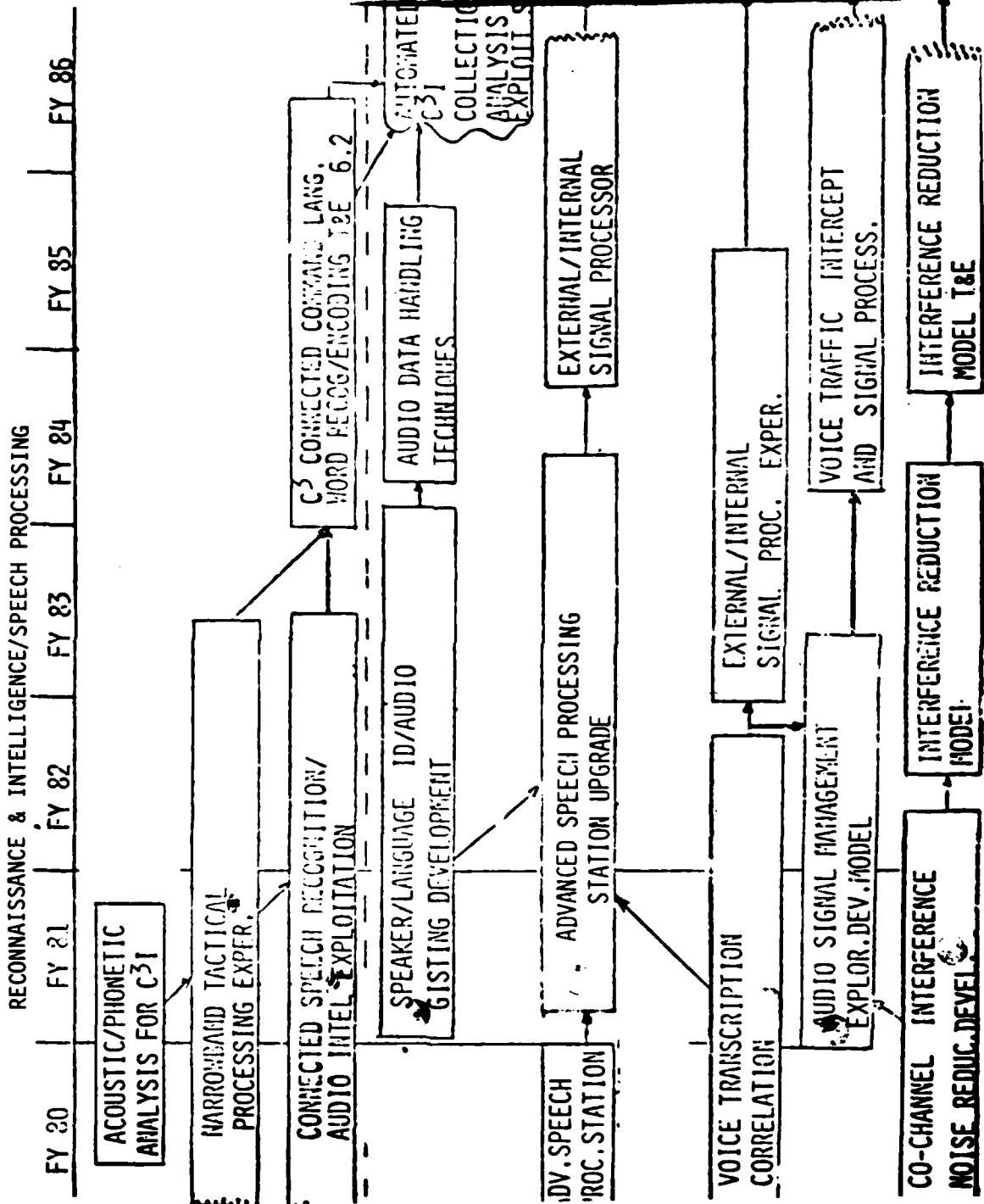
DEVELOPMENT OF AUTOMATED ACOUSTIC SIGNAL PROCESSING TECHNIQUES.

PAYOFF:

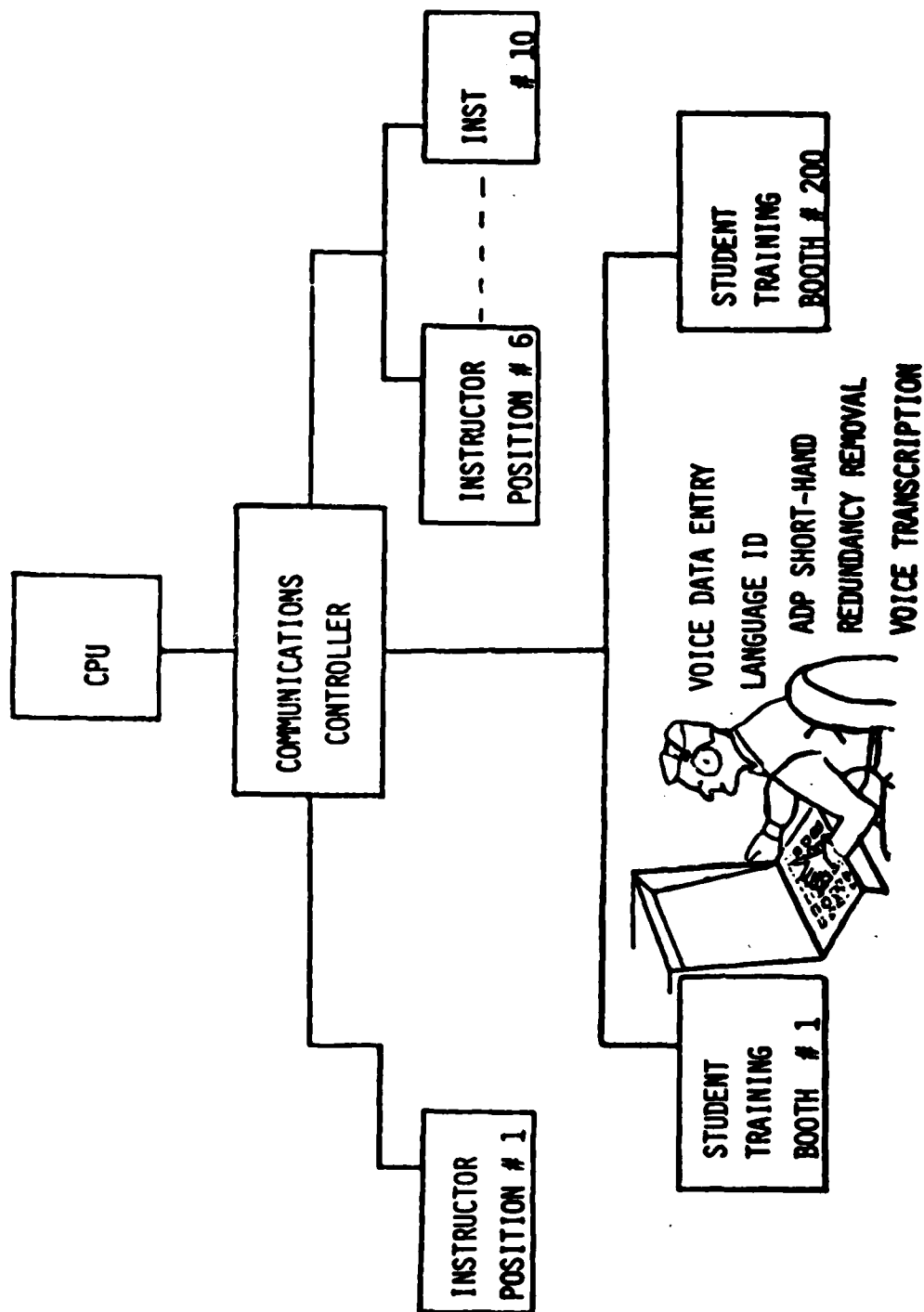
NATURAL CONNECTED WORD RECOGNITION FOR AIR FORCE C³I PROGRAMS.
AUTOMATED BACKGROUND NOISE ANALYSIS FOR FTD.

ADVANCED SPEECH PROCESSING STATION (ASPS)





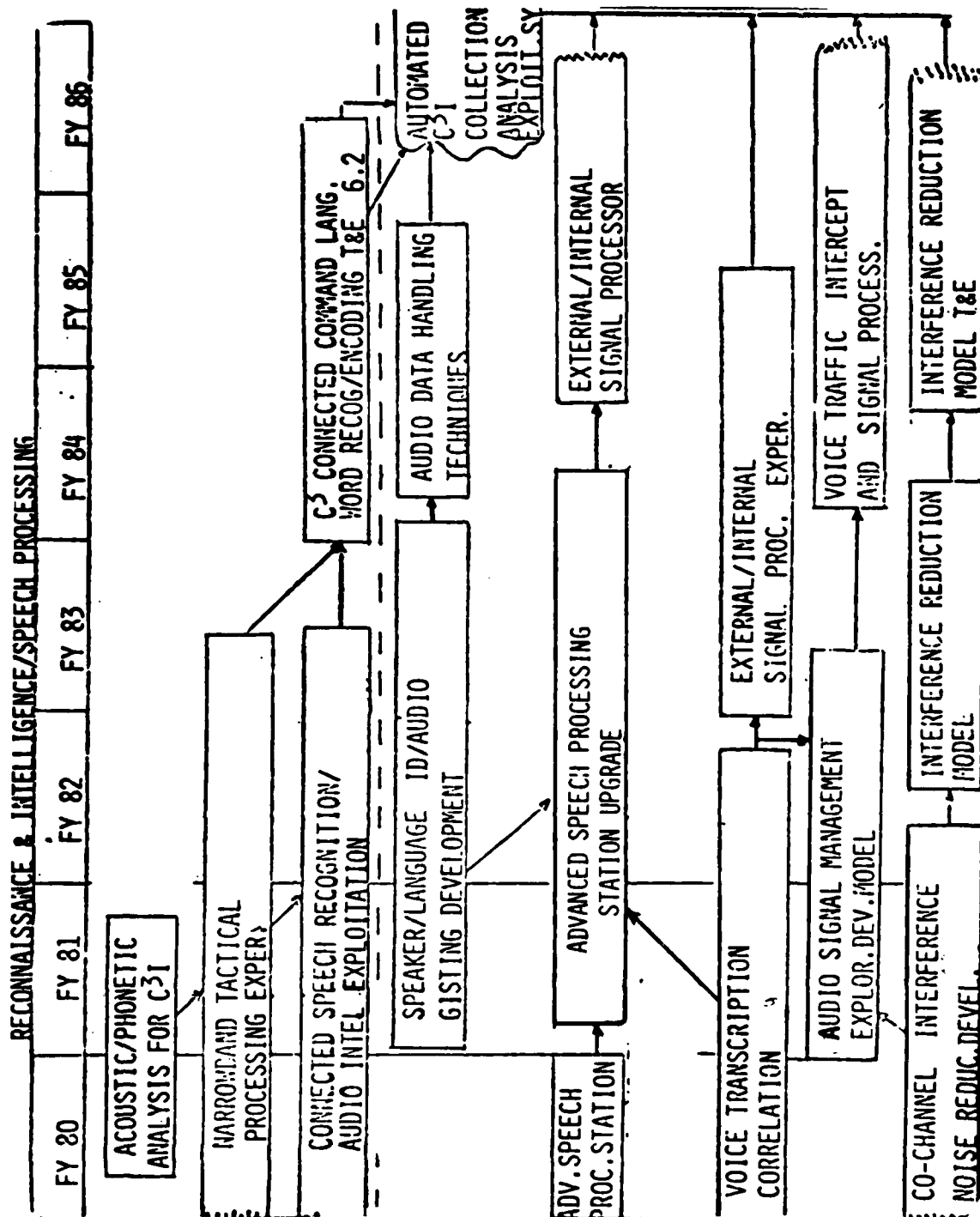
VOICE PROCESSOR TRAINING SYSTEM (VPTS)
(COMPUTER AIDED INSTRUCTIONS)



RADC SPEECH PROCESSING PROGRAM

TECH AREAS

DEVELOPMENT STAGE	VOICE DATA ENTRY	ENTRY CONTROL	MESSAGE SORTING	COMMUNICATIONS ENHANCEMENT
BASIC RESEARCH	IN-HOUSE DATA ENTRY TEST BED			PHONEMIC LOW DATA RATE COMMUNICATIONS
EXPLORATORY DEVELOPMENT	SOLID STATE, CONNECTED SPEECH, MULTI-MODE DATA ENTRY	DEVELOPMENT OF NEW PERSONAL ATTRIBUTES HYBRID SYSTEMS	KEYWORD/GISTING LANGUAGE ID. SPEAKER ID	IN-HOUSE LOW DATA RATE COMM, MULTI-TALKER SEPARATION, NOISE FILTER
ADVANCED DEVELOPMENT	DRUMS ADVANCED DEVELOPMENT MODEL	OPERATIONAL TESTING OF ADVANCED PIA DEVICES		SPEECH ENHANCEMENT OPERATIONAL T & E
ENGINEERING DEVELOPMENT	MULTI-STATION DRUMS VOICE DATA ENTRY	ENGINEERING DEVELOPMENT OF ASV		



KEY CONTACT POINTS

DR. BRUNO BEEK	-	RADC/1RAA	-	330-4024
MR. RICHARD S. VOHUSA	-	"	"	"
MR. EDWARD J. CUPPLES	-	"	"	"
MR. MELVIN G. MAYOR	-	"	"	"
LT JOHN V. FERRANTE	-	"	"	"
LT JEFFREY P. WOODARD	-	"	"	"

RADC EQUIPMENT/SYSTEM R&M PROGRAM

CONTACTS

ENGINEERING BRANCH (RBE) - ANTHONY J. FEDUCCIA - X4920

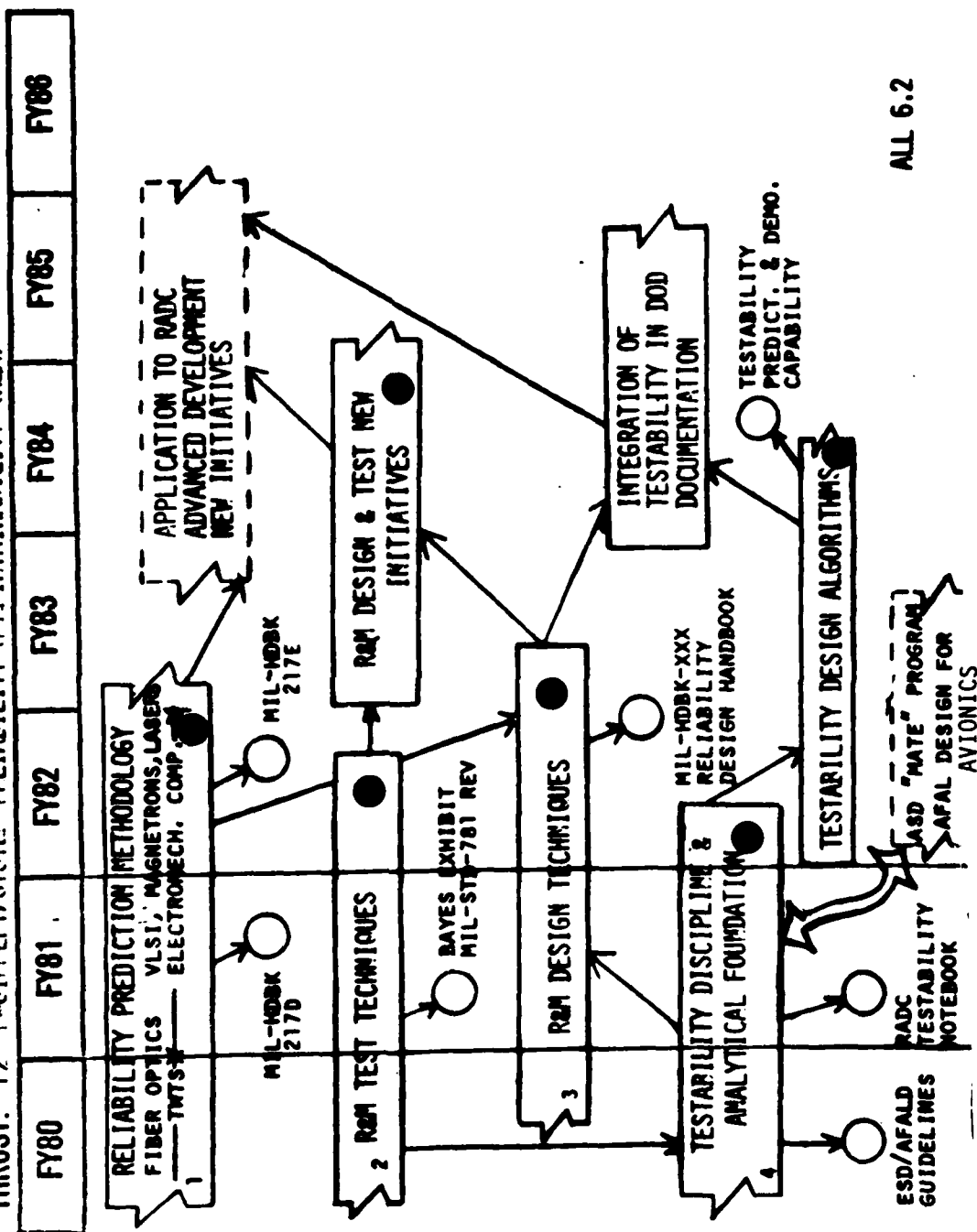
R&M ENGINEERING TECHNIQUES SECTION (RBET) - ANTHONY COPPOLA - X4726

R&M ENGINEERING SECTION (RBER) - ANTHONY D. PETTINATO - X2702

SYSTEM ENGINEERING SECTION (RBES) - RICHARD MAIR - X3068

RADC TPO IV TECHNOLOGY

THRUST: F2 EQUIPMENT/SYSTEM RELIABILITY & MAINTAINABILITY (R&M)



ALL 6.2

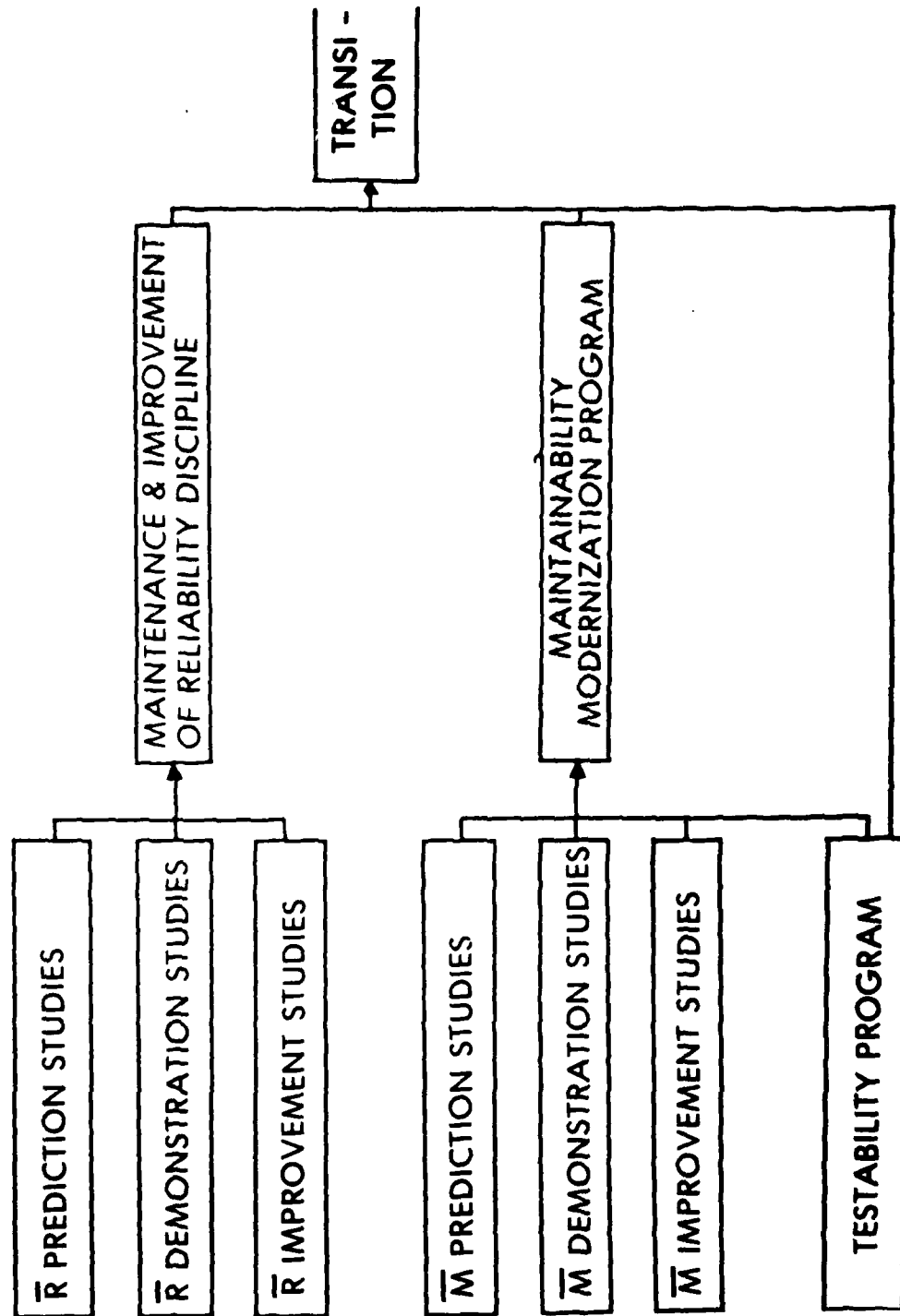
RADC EQUIPMENT/SYSTEM R&M PROGRAM

PRESENTATION OUTLINE

- **OVERVIEW**
- **RELIABILITY TECHNIQUES**
- **MAINTAINABILITY TECHNIQUES**
- **RELIABILITY ANALYSIS CENTER**
- **MILITARY STANDARDS AND HANDBOOKS**
- **R&M ENGINEERING SUPPORT**
- **SUMMARY**

RADC EQUIPMENT/SYSTEM R&M PROGRAM

OVERVIEW



RADC EQUIPMENT/SYSTEM R&M PROGRAM

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RELIABILITY TECHNIQUES

RELIABILITY PREDICTION

RELIABILITY= THE PROBABILITY THAT AN ITEM WILL PERFORM ITS INTENDED FUNCTION
FOR A SPECIFIED TIME UNDER STATED CONDITIONS.

$$R = e^{-(\sum \lambda_i) T}$$

MTBF= MEAN TIME BETWEEN FAILURES

$$MTBF = \frac{1}{\sum \lambda_i}$$

λ_i = FAILURE RATE OF AN INDIVIDUAL PART

PART FAILURE RATES CONTAINED IN MIL-HDBK-217
"RELIABILITY PREDICTION OF ELECTRONIC EQUIPMENT".

RELIABILITY TECHNIQUES

RELIABILITY PREDICTION

EXAMPLE OF FAILURE RATE MODEL FOR FIELD EFFECT TRANSISTORS

$$\lambda_P = \lambda_B (\pi_E \times \pi_A \times \pi_Q \times \pi_C) \text{ FAILURES/10}^6 \text{ HOURS}$$

WHERE:

λ_B = BASE FAILURE RATE

π_E = ENVIRONMENTAL FACTOR

π_A = APPLICATION FACTOR

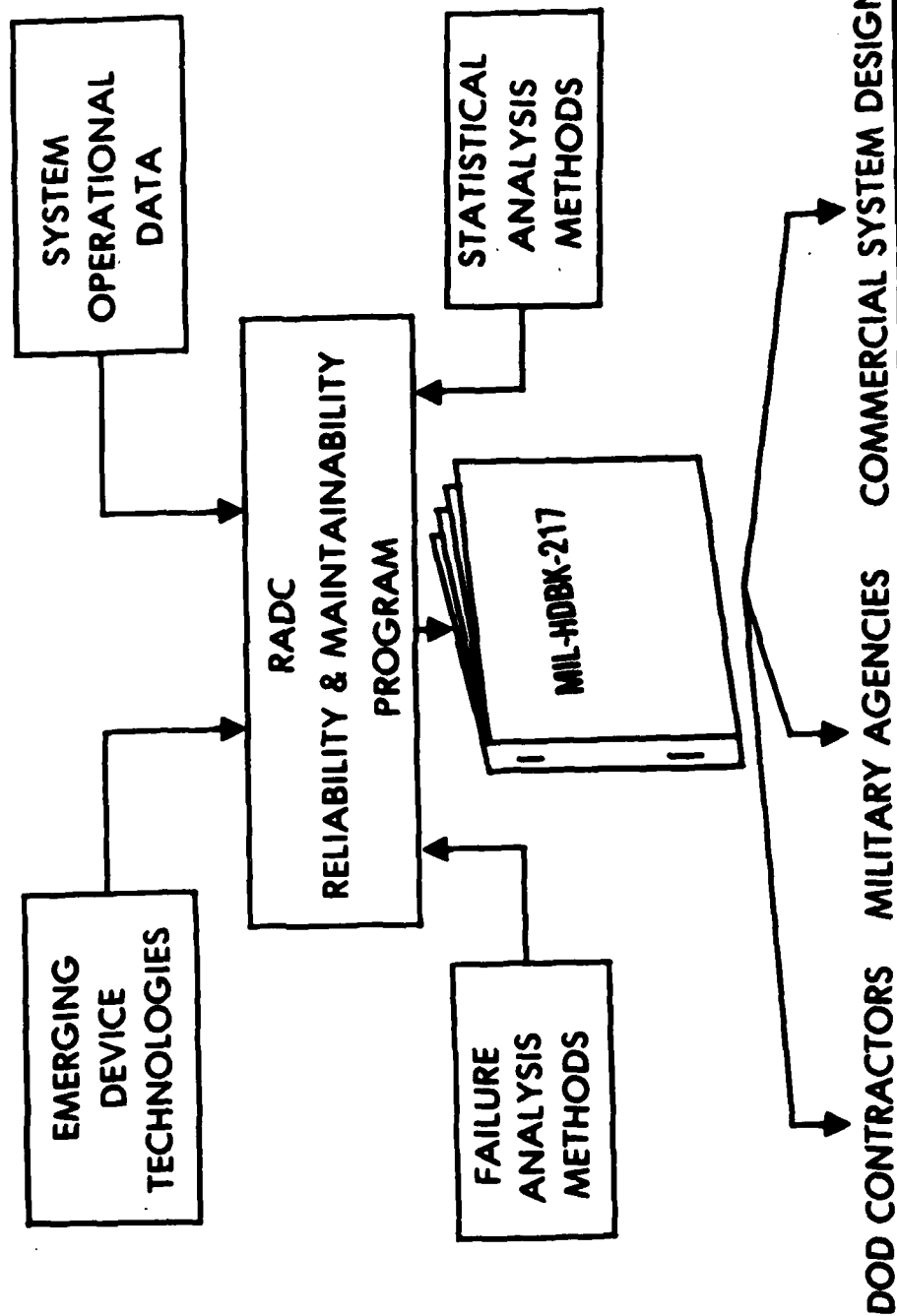
π_Q = QUALITY FACTOR

π_C = COMPLEXITY FACTOR

SOURCE: MIL-HDBK-217B "RELIABILITY PREDICTION OF ELECTRONIC EQUIPMENT"

RELIABILITY TECHNIQUES

RELIABILITY PREDICTION



RELIABILITY TECHNIQUES

RELIABILITY PREDICTION

MIL-HDBK-217C, NOTICE 1 AVAILABLE MAY 1980

- MONOLITHIC IC's (SSI/MSI/LSI)
- MICROWAVE SOLID STATE DEVICES

MIL-STD-217D SCHEDULED MARCH 1981

- CCD & BUBBLE MEMORIES
- GAAS FET
- ENVIRONMENTAL FACTORS (EXCEPT AVIONICS)

MIL-HDBK-217D REVISION SCHEDULED MARCH 1982

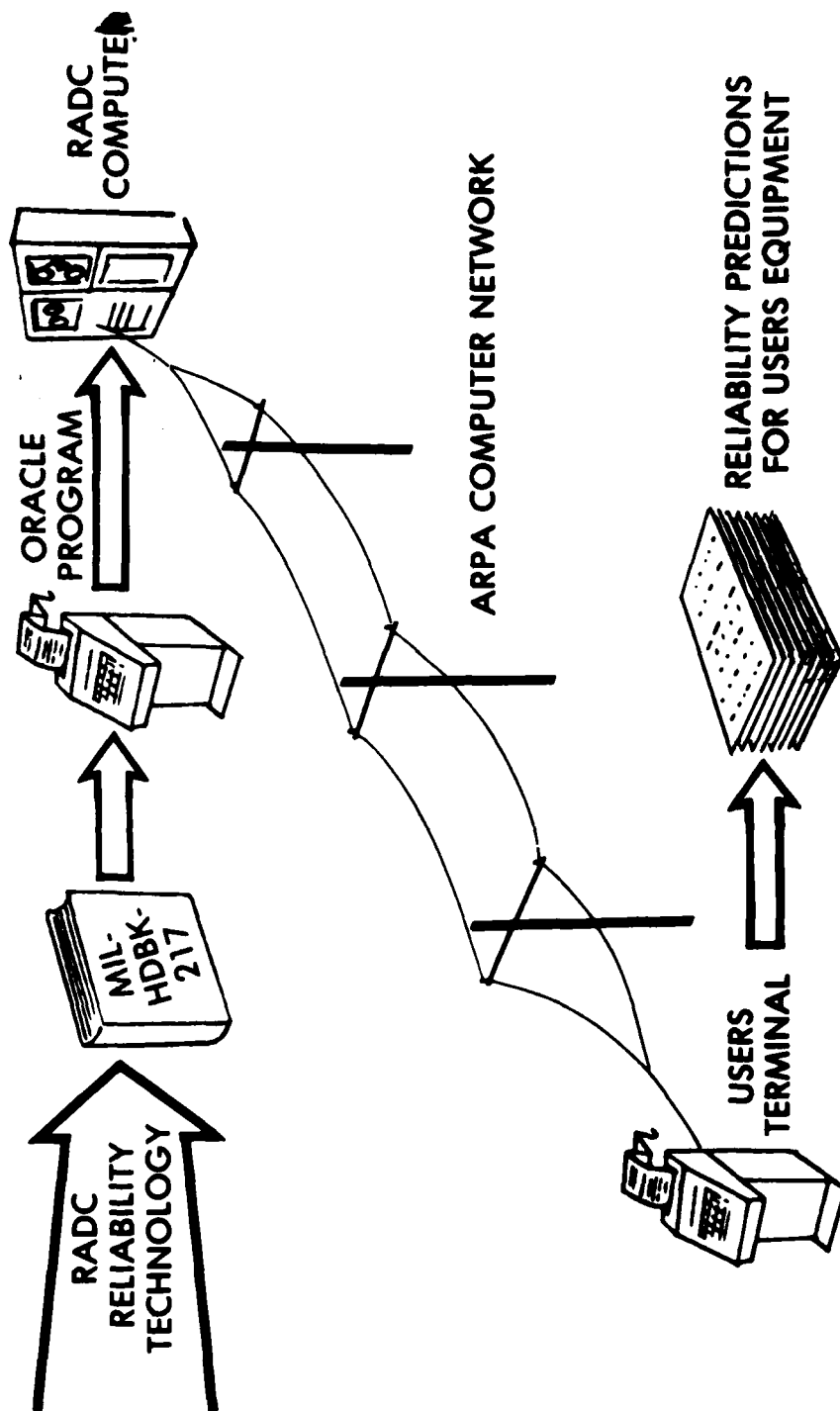
- MONOLITHIC IC's
- FIBRE OPTICS
- MICROWAVE POWER DEVICES
- TWT's
- AVIONIC ENVIRONMENTAL FACTORS

• FUTURE

- LASERS
- PC BOARDS
- IC SOCKETS
- VHSIC

RELIABILITY TECHNIQUES

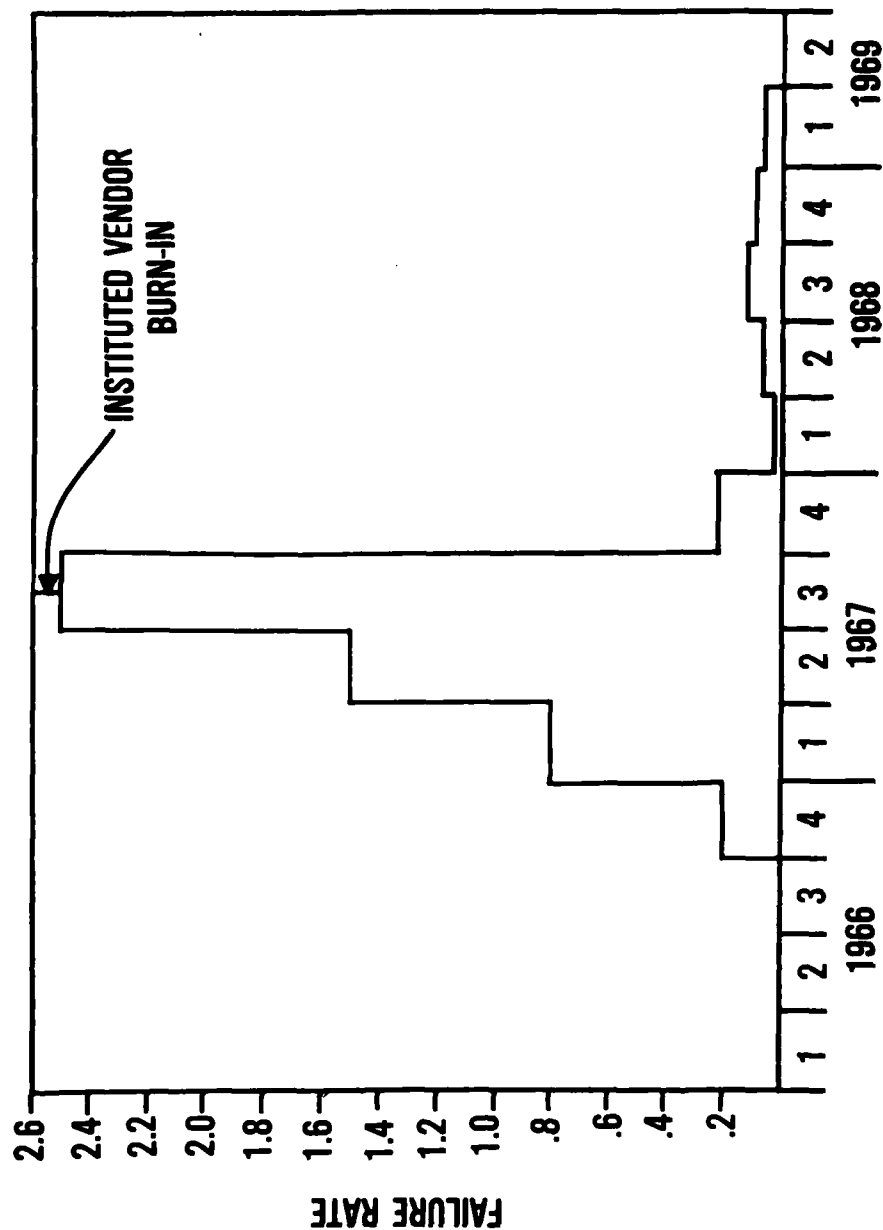
RADC-ORACLE RELIABILITY PREDICTION PROGRAM



RELIABILITY TECHNIQUES

EQUIPMENT BURN-IN

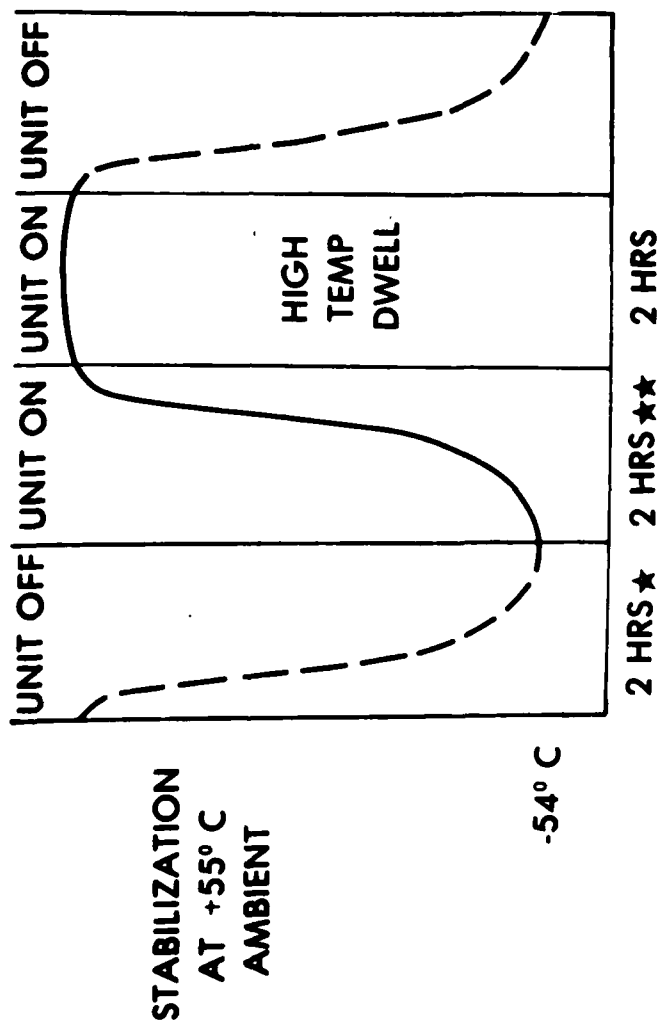
HVPS FAILURE RATE IN F-111 RADAR TESTS



RELIABILITY TECHNIQUES

EQUIPMENT BURN-IN

AN/ARC-164 BURN-IN CYCLE



- ★ TIME TO STABILIZE AT -54° C WITH UNIT OFF
- ★★ TIME TO STABILIZE AT +55° C WITH UNIT ON

RELIABILITY TECHNIQUES

EQUIPMENT BURN-IN

AN/ARC-164 BURN-IN

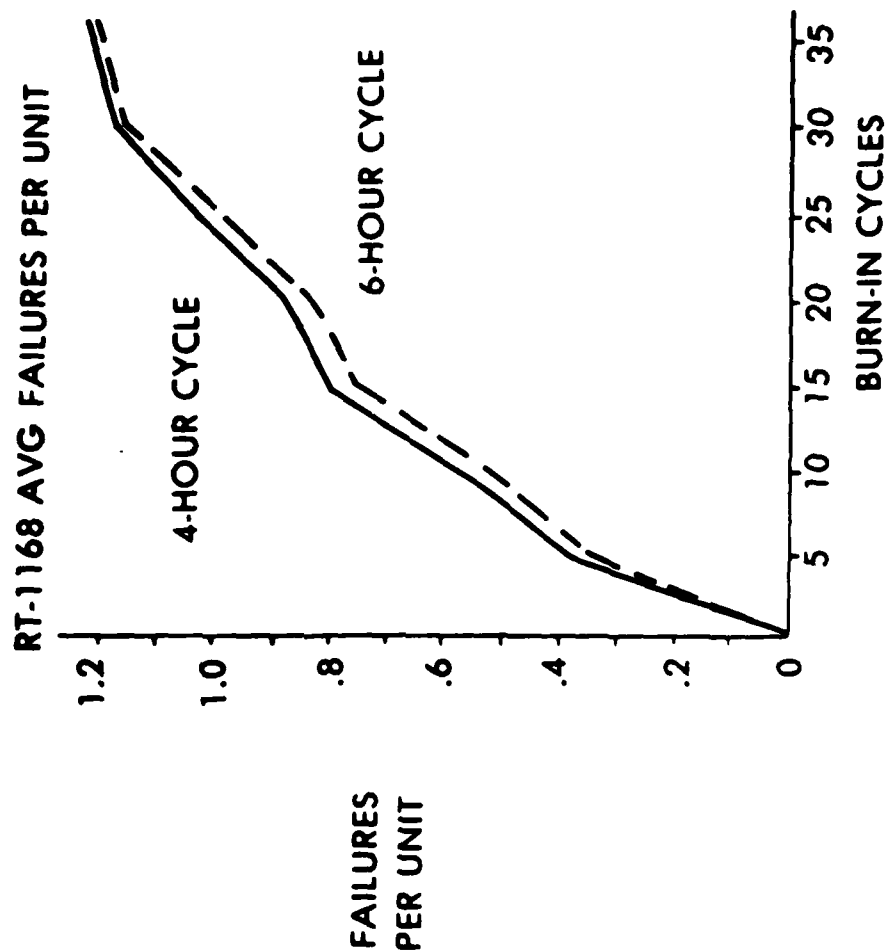
HYPOTHESIS:

**AN/ARC-164 DEFECTS ARE MORE SENSITIVE TO
THERMAL CYCLES THAN TO SUSTAINED HIGH
TEMPERATURE .**

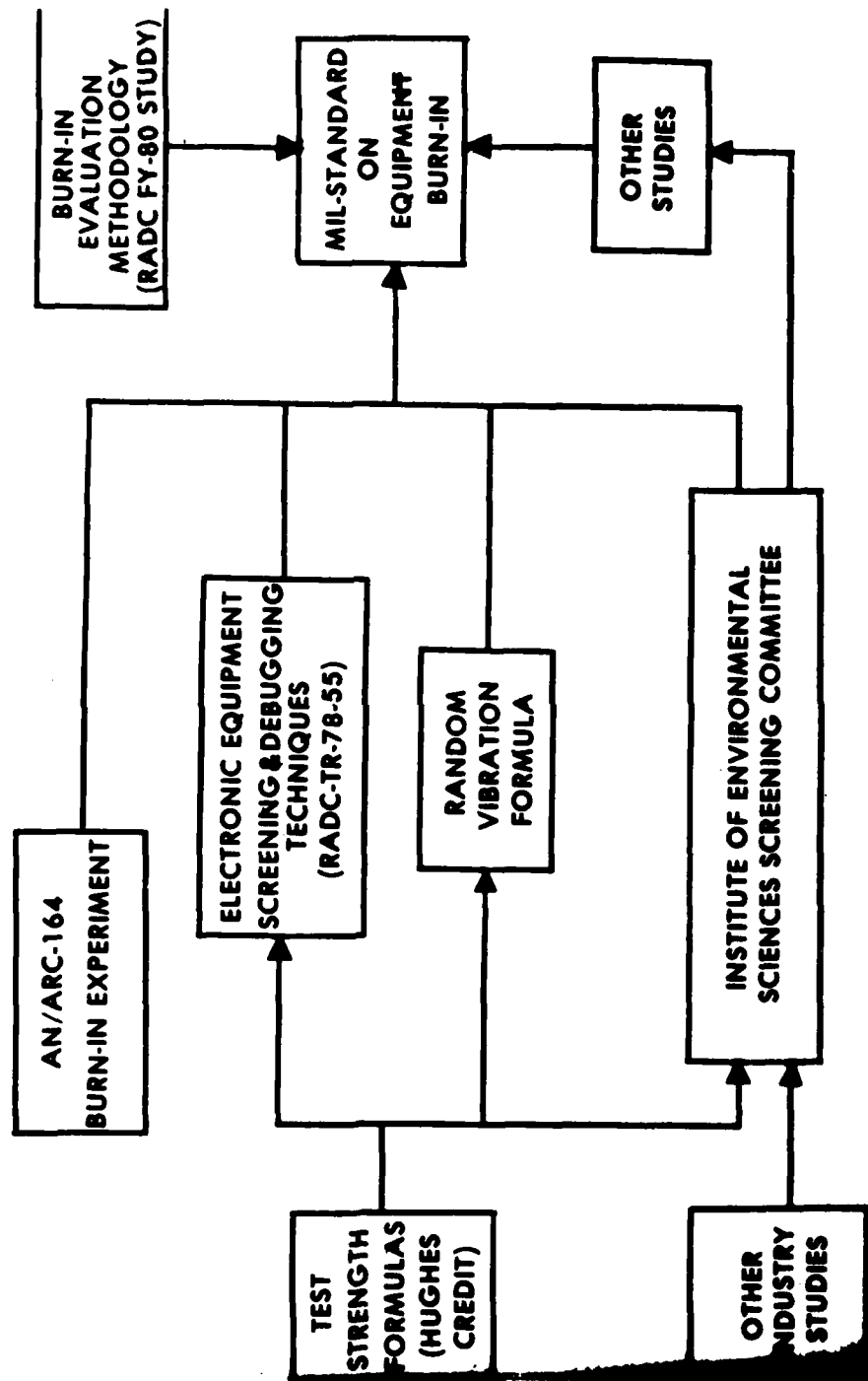
EXPERIMENT:

**HALF OF THREE MONTHS PRODUCTION BURNED-
IN WITHOUT 2 HOUR HIGH TEMPERATURE DWELL.
FAILURE HISTORY COMPARED TO OTHER HALF.**

**RELIABILITY TECHNIQUES
EQUIPMENT BURN-IN
AN/ARC-164 BURN-IN**



RELIABILITY TECHNIQUES EQUIPMENT BURN-IN



RELIABILITY TECHNIQUES

OTHER STUDIES OF INTEREST

COMPLETED

**WARRANTY-GUARANTEE APPLICATION GUIDELINES FOR
AIR FORCE GROUND ELECTRONIC EQUIPMENT (RADC-TR-79-287)**

IN PROGRESS

COMBINED HARDWARE-SOFTWARE RELIABILITY MODELS

SCHEDULED FOR FY-81

- **PART DERATING GUIDELINES**
- **SNEAK CIRCUIT ANALYSIS**
- **RELIABILITY OF COMMERCIAL EQUIPMENT**
- **RELIABILITY DESIGN HANDBOOK**
- **FAULT TOLERANCE IN DISTRIBUTED SYSTEMS**
- **NON-ELECTRONICS COMPONENT RELIABILITY**

RADC EQUIPMENT/SYSTEM R&M PROGRAM

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MAINTAINABILITY TECHNIQUES

MAINTAINABILITY PROBLEMS

PREDICTION METHODS ARE OBSOLETE:

- **BASED ON REGRESSION ANALYSIS OF EQUIPMENTS BUILT 15 YEARS AGO**
- **DO NOT ACCOUNT FOR MODULARITY, MODERN DIAGNOSTIC METHODS, BUILT-IN TEST**
- **DO NOT IMPACT DESIGN**

FIGURES OF MERIT HAVE UNDESIRABLE CHARACTERISTICS

MAINTAINABILITY TECHNIQUES

MAINTAINABILITY PREDICTION

**MODERN MAINTAINABILITY PREDICTION TECHNIQUE PUBLISHED
IN RADC-TR-78-169, MAINTAINABILITY PREDICTION AND ANALYSIS
STUDY**

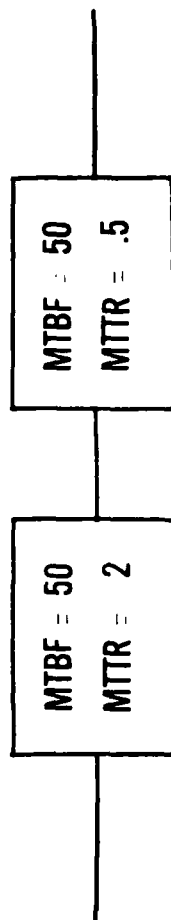
- **APPLICABLE TO MODERN TECHNOLOGY**
- **CONTAINS METHOD FOR DESIGN TRADES**

**TO BE TRANSITIONED VIA MIL HDBK-472, MAINTAINABILITY
PREDICTION**

VALIDATION STUDIES SCHEDULED FOR FY-81

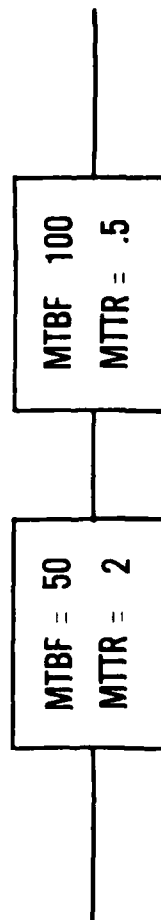
MAINTAINABILITY TECHNIQUES

COMPUTING SYSTEM MEAN TIME TO REPAIR



$$MTTR = 1/2 (2) + 1/2 (.5) = 1.25$$

IF RELIABILITY IMPROVES:



$$MTTR = 2/3 (2) + 1/3 (.5) = 1.5$$

∴ MTTR CAN DEGRADE IF RELIABILITY IMPROVES

MAINTAINABILITY TECHNIQUES

A BETTER APPROACH TO COMPUTING MAINTAINABILITY

MAINTENANCE HOURS/OPERATING HOUR

$$\frac{\text{MRT}}{\text{MTBF}} = \text{PER LRU}$$

$$\sum \frac{\text{MRT}}{\text{MTBF}} = \text{PER EQUIPMENT}$$

$$A = \frac{1}{1 + \sum \frac{\text{MRT}}{\text{MTBF}}}$$

- FIGURE IMPROVES AS EITHER RELIABILITY OR MAINTAINABILITY IMPROVE
- COMPUTATIONS ARE SIMPLIFIED

MAINTAINABILITY TECHNIQUES

RADC TESTABILITY PROGRAM

RADC R&M MISSION: DEVELOP METHODS FOR PREDICTING,
DEMONSTRATING, & IMPROVING
RELIABILITY & MAINTAINABILITY (R&M)

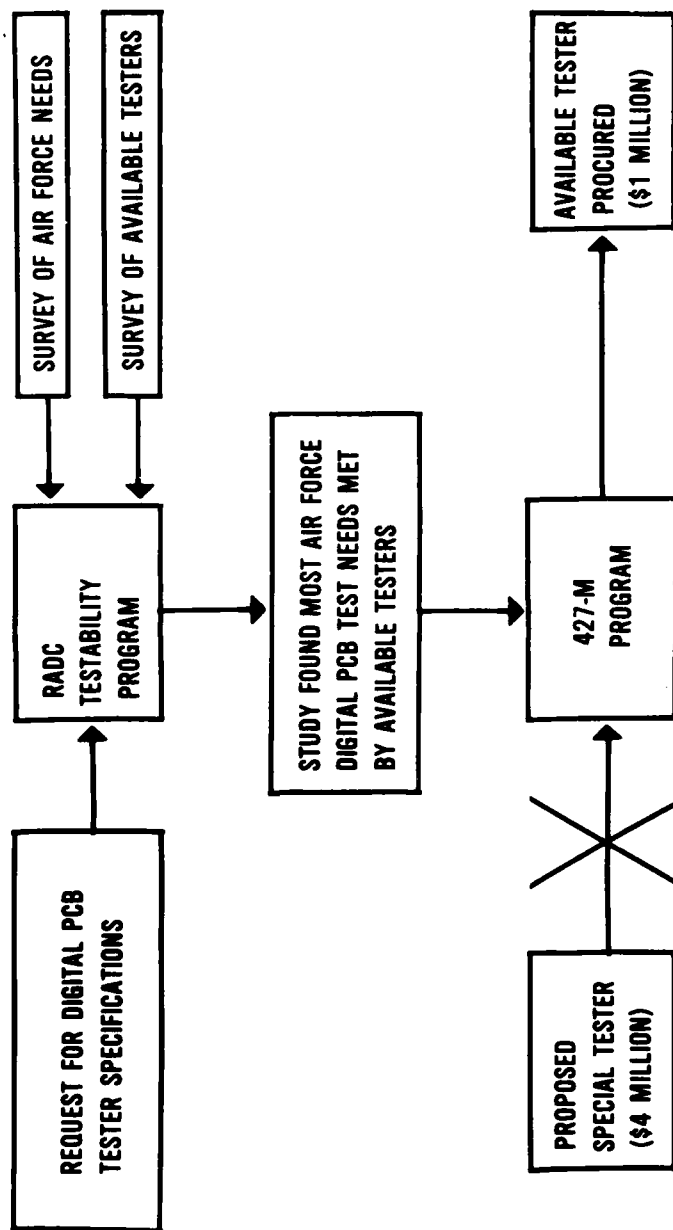
TESTABILITY IMPACT: MAINTAINABILITY PREDICTION &
DEMONSTRATION TECHNIQUES MUST CONSIDER
FAULT DETECTION & ISOLATION PARAMETERS
(TESTABILITY)

TESTABILITY STATUS: A NEGLECTED ENGINEERING DISCIPLINE WITH A
SIGNIFICANT IMPACT ON LIFE CYCLE COSTS

MAINTAINABILITY TECHNIQUES

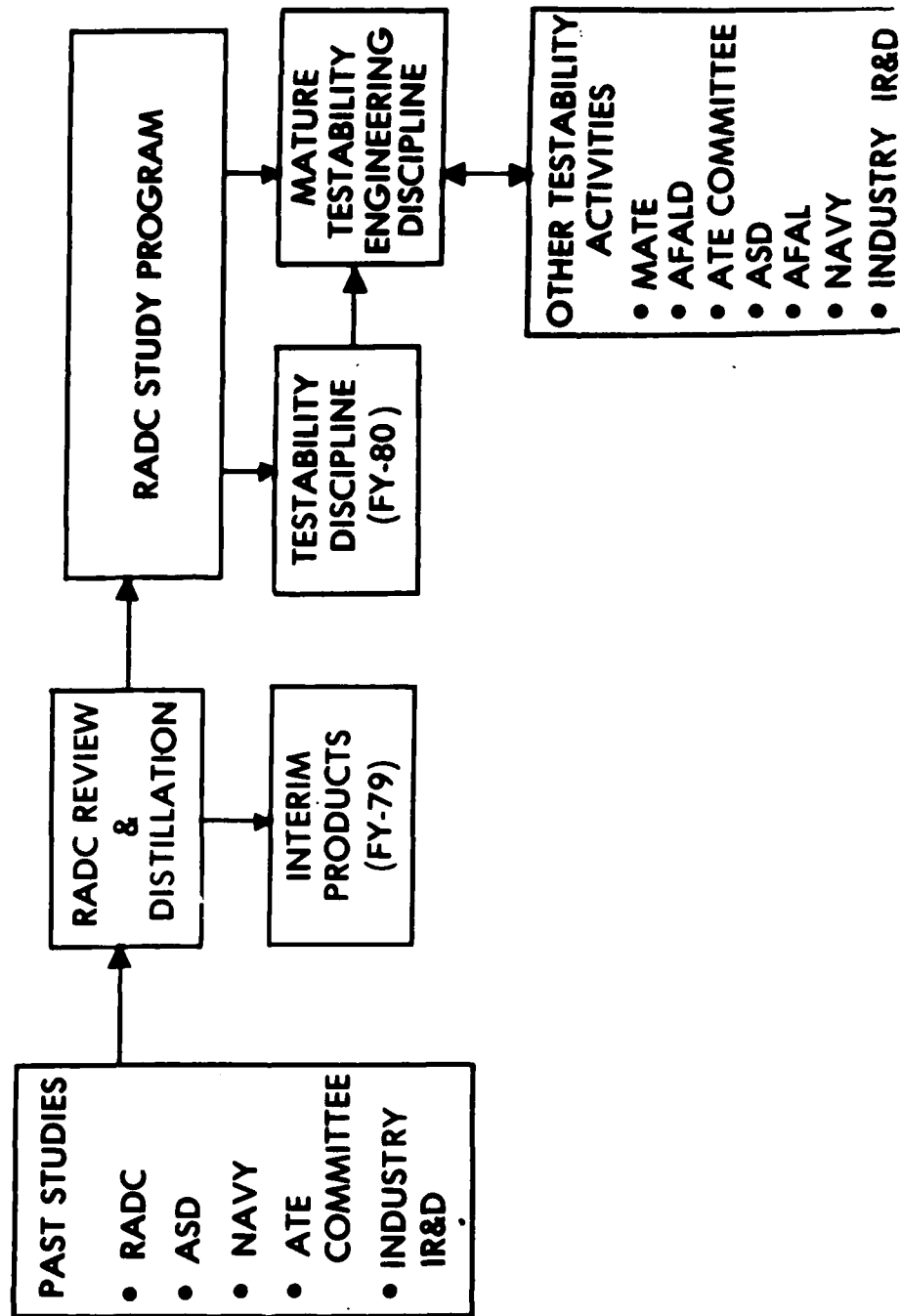
RADC TESTABILITY PROGRAM

EXAMPLE OF COST IMPACT



MAINTAINABILITY TECHNIQUES

RADC TESTABILITY PROGRAM



MAINTAINABILITY TECHNIQUES **RADC TESTABILITY PROGRAM**

TESTABILITY DISCIPLINE NEEDS	RADC PRODUCTS
<ul style="list-style-type: none"> • SPECIFYABLE FIGURES OF MERIT • DEMONSTRATION METHODOLOGY 	<ul style="list-style-type: none"> • BIT/EXTERNAL FIGURES OF MERIT AND DEMONSTRATION TECHNIQUES (RADC-TR-79-309)
<ul style="list-style-type: none"> • DESIGN TOOLS 	<ul style="list-style-type: none"> • DESIGN GUIDELINES AND OPTIMIZATION PROCEDURES FOR TEST SUBSYSTEM DESIGN (RADC-TR-80-XXX) • AN OBJECTIVE PRINTED CIRCUIT BOARD TESTABILITY DESIGN GUIDE AND RATING SYSTEM (RADC-TR-79-327) • BIT-EXTERNAL TESTER RELIABILITY CHARACTERISTICS (RADC-TR-80-32)
<ul style="list-style-type: none"> • COST TRADE-OFFS 	<ul style="list-style-type: none"> • OPERATION AND SUPPORT COST CHARACTERISTICS OF TESTERS AND TEST SUBSYSTEMS (RADC-TR-79-334) • AVAILABILITY/OPERATIONAL READINESS TEST SUBSYSTEM COST TRADE-OFFS (RADC-TR-80-XXX)

MAINTAINABILITY TECHNIQUES

OTHER MAINTAINABILITY/TESTABILITY STUDIES

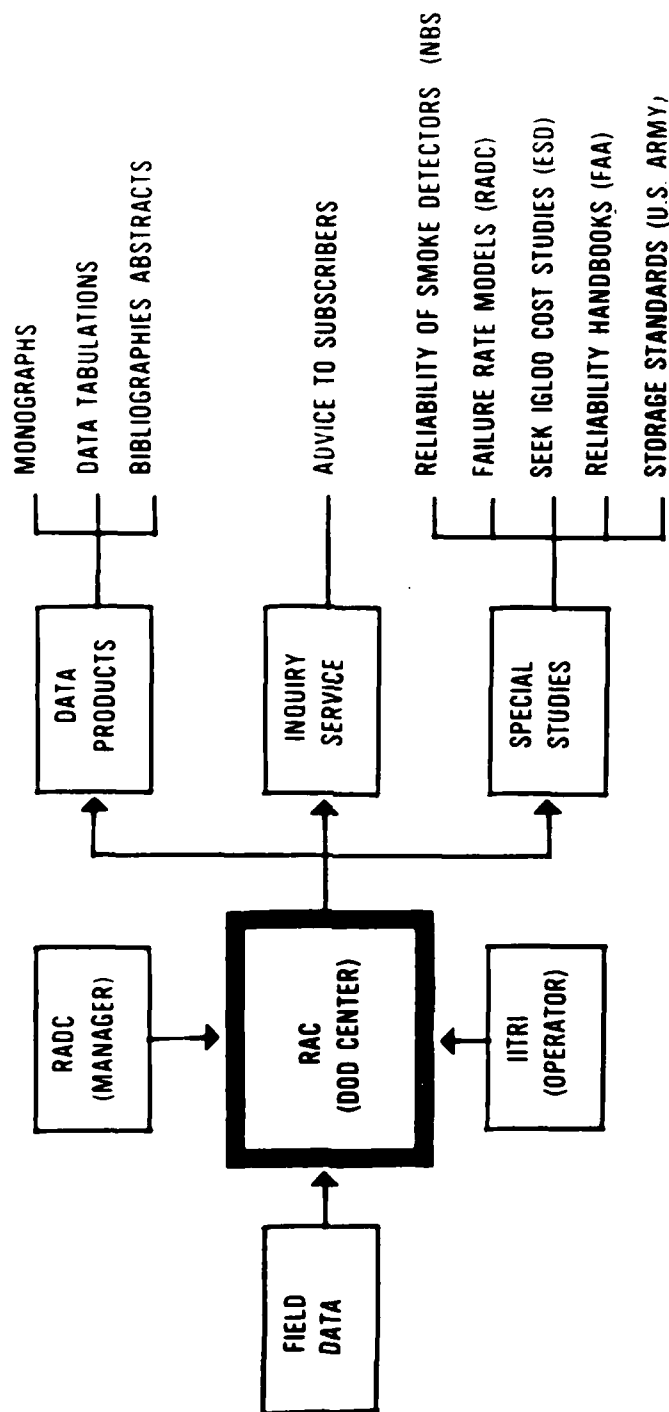
IN PROGRESS

- TESTABILITY NOTEBOOK
- FMEA METHODOLOGY
- CAUSES OF UNNECESSARY REMOVALS
- STUDY OF FALSE ALARMS

PLANNED FOR FY-81

- ANALYTICAL PROCEDURES FOR TESTABILITY
- FAULT TOLERANCE IN DISTRIBUTED SYSTEMS
- BIT HARDWARE/SOFTWARE TRADE-OFFS
- TESTER SOFTWARE COST ESTIMATION
- NON-ELECTRONIC COMPONENT TESTABILITY
- PROGRAMMABLE INTERFACES

RELIABILITY ANALYSIS CENTER



RADC EQUIPMENT/SYSTEM R&M PROGRAM

PRESENTATION OUTLINE

- **OVERVIEW**
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RADC EQUIPMENT/SYSTEM R&M PROGRAM

MILITARY STANDARDS AND HANDBOOKS

RADC IS DOD PREPARING ACTIVITY FOR:

MIL-HDBK-217	RELIABILITY PREDICTION OF ELECTRONIC EQUIPMENT
MIL-STD-470	MAINTAINABILITY PROGRAM REQUIREMENTS
MIL-STD-471	MAINTAINABILITY VERIFICATION/DEMONSTRATION/EVALUATION
MIL-STD-1591	ON AIRCRAFT FAULT DIAGNOSIS SUB-SYSTEMS ANALYSIS/SYNTHESIS OF
MIL-STD-001591 (USAF)	COMMAND, CONTROL AND COMMUNICATIONS (C³) SYSTEM & COMPONENT FAULT DIAGNOSIS, SUBSYSTEMS, ANALYSIS/SYNTHESIS OF

RADC EQUIPMENT/SYSTEM R&M PROGRAM

MILITARY STANDARDS AND HANDBOOKS

RADC IS AIR FORCE CUSTODIAN OF:

MIL-STD-756	RELIABILITY PREDICTION
MIL-STD-721	DEFINITION OF EFFECTIVENESS TERMS FOR RELIABILITY, MAINTAINABILITY, HUMAN FACTORS & SAFETY
MIL-HDBK-472	MAINTAINABILITY PREDICTION
MIL-STD-1629	PROCEDURES FOR PERFORMING A FMECA

RADC IS A REVIEWING ACTIVITY FOR:

MIL-STD-781	RELIABILITY TESTS: EXPONENTIAL DISTRIBUTION
MIL-STD-785	RELIABILITY PROGRAM FOR SYSTEMS & EQUIPMENT

ALL OTHER DOD R&M DOCUMENTS

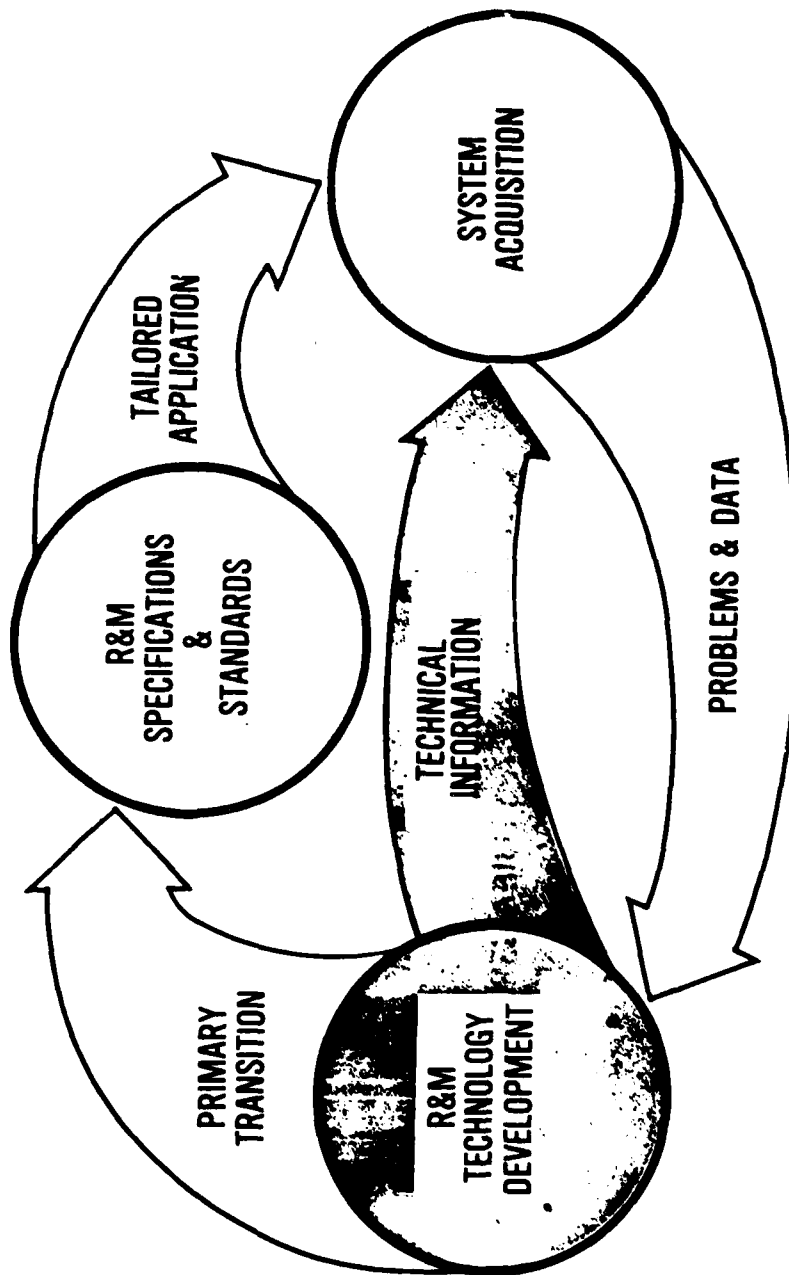
RADC EQUIPMENT/SYSTEM R&M PROGRAM

R&M ENGINEERING SUPPORT

- **PREPARE R&M REQUIREMENTS**
- **EVALUATE PROPOSALS**
- **REVIEW R&M PROGRAM PLANS**
- **EVALUATE R&M PREDICTIONS**
- **MONITOR R&M PROGRAM**
- **REVIEW R&M DEMONSTRATION PLANS**
- **REVIEW & ANALYZE TEST RESULTS**
- **PROVIDE SPECIALIZED SERVICES**

RADC EQUIPMENT/R&M SYSTEM PROGRAM

SUMMARY



☒ UNIQUE RADC CAPABILITY
 ☐ RADC LEADING ROLE
 ☐ MANY DIFFERENT AGENCIES

INDUSTRY LOOKS AT RADC 1980

SOFTWARE ENGINEERING SUB-THRUST - TPO 463

D. F. BERGSTROM
SOFTWARE ENGINEERING SECTION
ISIE/5827

F/G 5/1

RADC-TR-80-195-VOL-3

NL

UNCLASSIFIED

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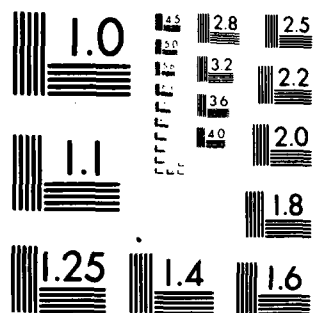
$$d_0 \approx 10^{-10} \text{ m}$$

END

DATE _____

84. MEU
 85. MEU

88



MICROCOPY RESOLUTION TEST CHART
NATIONAL BUREAU OF STANDARDS 1963 A

TPO/THRUST: 46 INFORMATION PROCESSING

SUB-THRUST: 463 SOFTWARE ENGINEERING

PROGRAM GOALS: DEVELOP AND EXPLOIT SOFTWARE ENGINEERING TECHNOLOGY FOR IMPROVED SYSTEM PERFORMANCE, QUALITY, AND RELIABILITY. ENFORCE ENGINEERING DISCIPLINE FOR SOFTWARE PRODUCTION AND TAKE ADVANTAGE OF MODERN PROGRAMMING PRACTICES. IMPROVE MANAGEMENT VISIBILITY INTO THE SOFTWARE LIFE CYCLE.

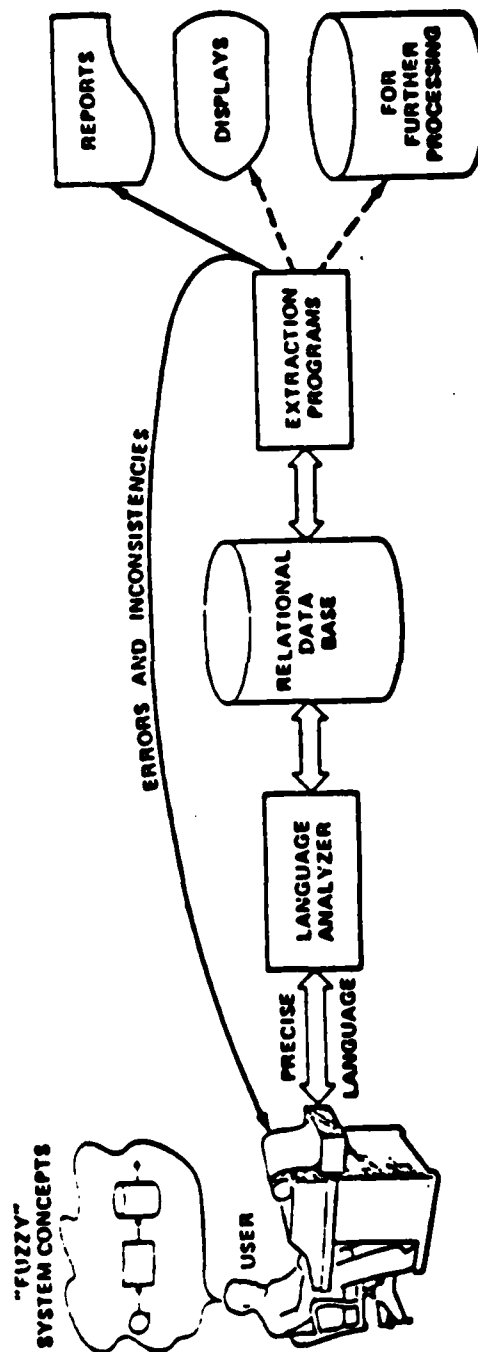
TECHNICAL AREAS:

- REQUIREMENTS SPECIFICATION ENGINEERING
- DESIGN AND MANAGEMENT
- SOFTWARE TOOLS
- STANDARDS
- DATA COLLECTION
- MODELING
- QUALITY MEASUREMENTS

REQUIREMENTS SPECIFICATION ENGINEERING

- AUTOMATED REQUIREMENTS ANALYSIS TECHNOLOGY HAS POTENTIAL FOR GREATEST LEVERAGE IN REDUCING SYSTEM LIFE CYCLE COSTS.
- PROGRAM BASELINE - SREM SELECTED AS MOST SUITABLE TECHNOLOGY FOR SOFTWARE AND SYSTEM REQUIREMENTS ANALYSIS.

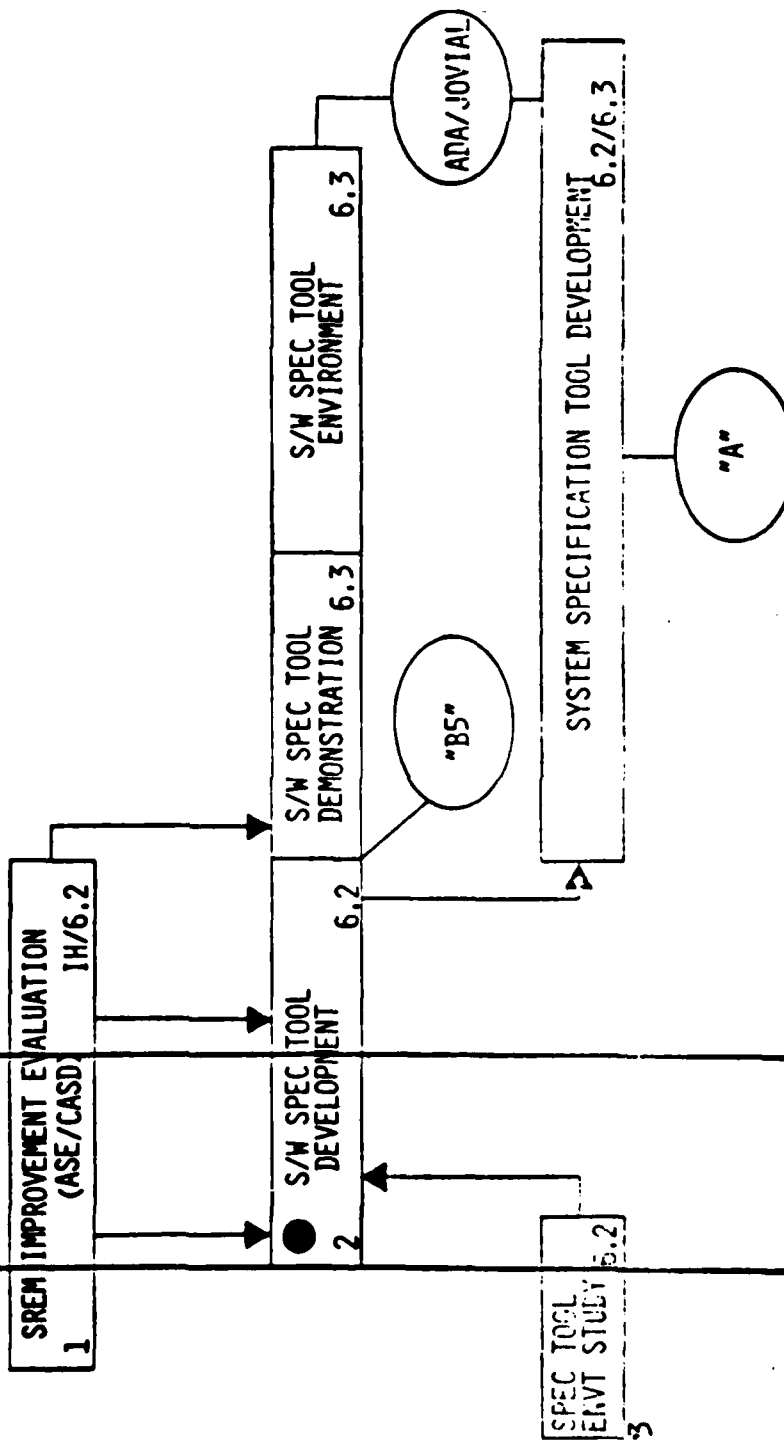
REQUIREMENTS SPECIFICATION ENGINEERING



RADC IP0 4G INFORMATION PROCESSING

THRUST: 4G3 SOFTWARE ENGINEERING (REQUIREMENTS SPECIFICATION ENGINEERING)

FY80	FY81	FY82	FY83	FY84	FY85	FY86
------	------	------	------	------	------	------



TPO/THRUST #/TITLE: 46 INFORMATION PROCESSING

SUB-THRUST #/TITLE: 463 SOFTWARE ENGINEERING (REQUIREMENTS SPECIFICATION ENGINEERING)

EFFORT BLOCK TITLE: SOFTWARE SPECIFICATION TOOL DEVELOPMENT

OBJECTIVE:

- DEVELOP METHODOLOGY AND TOOLS FOR AUTOMATED REQUIREMENTS SPECIFICATION ANALYSIS.
- PROVIDE CAPABILITY TO VALIDATE MIL-STD 490 TYPE B5 SPECIFICATIONS.

TECHNICAL APPROACH:

- UTILIZE SREM AS BASELINE TECHNOLOGY.
- ENHANCEMENTS FOR C31 EMBEDDED COMPUTER SYSTEMS.

PAY OFF:

- INTEGRATED SET OF SPECIFICATION EVALUATION TOOLS.
- LIFE CYCLE COST REDUCTION - EARLY DETECTION/CORRECTION OF SPECIFICATION PROBLEMS.
- CONSISTENT, COMPLETE, UNAMBIGUOUS SPECIFICATIONS.

DESIGN AND MANAGEMENT

- MERGE ADVANCED DESIGN TECHNIQUES WITH AUTOMATED REQUIREMENTS SPECIFICATION TECHNOLOGY.
- PROVIDE MANAGEMENT CAPABILITY TO PREDICT SOFTWARE LIFE CYCLE COSTS.
- DEVELOP TECHNIQUES TO PERFORM COST/PERFORMANCE TRADEOFFS DURING SYSTEM CONCEPT AND VALIDATION PHASES.

THRUST: 463 SOFTWARE ENGINEERING (DESIGN AND MANAGEMENT) (CONTD)



TPO/THRUST #/TITLE: 46 INFORMATION PROCESSING

SUB-THRUST #/TITLE: 463 SOFTWARE ENGINEERING (DESIGN AND MANAGEMENT)

EFFORT BLOCK TITLE: SOFTWARE COST MODEL DEVELOPMENT

OBJECTIVE: DEVELOP ADVANCED MODELS FOR PREDICTING SOFTWARE LIFE CYCLE COSTS.

TECHNICAL APPROACH:

- UTILIZE RESULTS OF ONGOING STATE-OF-THE-ART ANALYSIS.
- SELECT AND DEVELOP "BEST FIT" COST MODEL(S).
- VALIDATE MODEL USING ACTUAL SOFTWARE COST DATA

PAY OFF:

- IMPROVED CAPABILITY TO ESTIMATE LIFE CYCLE COSTS DURING CONCEPT/VALIDATION PHASES.
- AVOID UNANTICIPATED COST OVERRUNS.

TPO/THRUST #/TITLE: 46 INFORMATION PROCESSING

SUB-THRUST #/TITLE: 463 SOFTWARE ENGINEERING DESIGN AND MANAGEMENT

EFFORT BLOCK TITLE: FRAMEWORK FOR SOFTWARE QUALITY TRADE-OFF ANALYSIS

OBJECTIVE: DEVELOP CAPABILITY TO PERFORM SOFTWARE COST VS. QUALITY TRADE-OFFS.

TECHNICAL APPROACH:

- SIMULATE SOFTWARE ACQUISITION LIFE CYCLE.
- INCLUDE CAPABILITY TO VARY DEVELOPMENT APPROACHES.
- MERGE LIFE CYCLE COST MODELS AND QUALITY FACTOR CRITERIA.

PAY OFF:

- COST/QUALITY TRADE-OFF STUDIES DURING CONCEPT AND VALIDATION PHASE.
- CAPABILITY TO SELECT FROM ALTERNATIVE DEVELOPMENT APPROACHES.
- MATCH SELECTED APPROACH TO AVAILABLE RESOURCES.

SOFTWARE TOOLS

- DEVELOP SOFTWARE TESTING TOOLS AND PROCEDURES TO OBTAIN MORE EFFECTIVE TESTING PER AF DOLLAR.
- PROVIDE APPLICATION PROGRAM TEST GUIDANCE TO OPTIMIZE TESTING APPROACH.
- INVESTIGATE AND DEVELOP SOFTWARE TOOLS TO COPE WITH UNIQUE ATTRIBUTES OF DISTRIBUTED SYSTEMS.

TPO/THRUST #/TITLE: 46 INFORMATION PROCESSING

SUB-THRUST #/TITLE: 463 SOFTWARE ENGINEERING (SOFTWARE TOOLS)

EFFORT BLOCK TITLE: SOFTWARE TEST HANDBOOK

OBJECTIVE: PRODUCE HANDBOOK TO MATCH SOFTWARE TESTING APPROACH TO APPLICATION ENVIRONMENT.

TECHNICAL APPROACH:

- DETERMINE APPLICABLE COST-EFFECTIVE TECHNIQUES AND TOOLS.
- DEVELOP STEP-WISE METHODOLOGY FOR APPLYING TEST METHODS.

PAY OFF:

- HANDBOOK PROVIDES FOCUS ON SOFTWARE TEST METHODOLOGY.
- SOFTWARE TEST GUIDANCE AND IMPROVED TEST STRATEGY.

THRUST: 463 SOFTWARE ENGINEERING (SOFTWARE TOOLS) (CONTD)

**LIFE CYCLE TOOLS
FOR DISTRIBUTED SYSTEMS**

TPO/THRUST #/TITLE: 46 INFORMATION PROCESSING

SUB-THRUST #/TITLE: 463 SOFTWARE ENGINEERING (SOFTWARE TOOLS)

EFFORT BLOCK TITLE: SOFTWARE RE-TEST TECHNIQUES

OBJECTIVE: IMPROVE SOFTWARE RE-TEST METHODS FOR IMPLEMENTED SYSTEMS.

TECHNICAL APPROACH:

- EXAMINE REQUIREMENTS FOR SOFTWARE RE-TEST DURING OPERATION AND MAINTENANCE PHASE.
- DETERMINE APPLICABLE STATE-OF-THE-ART METHODS.
- SPECIFY NEW OR AUGMENTED TECHNOLOGIES FOR SOFTWARE RE-TEST.

PAY OFF:

- IMPROVEMENTS TO SOFTWARE SUPPORT ACTIVITIES - MODIFICATION AND ERROR CORRECTION.
- ACCOMMODATE SOFTWARE MAINTENANCE "RIPPLE EFFECT".

TPO/THRUST #/TITLE: 4G INFORMATION PROCESSING

SUB-THRUST #/TITLE: 4G3 SOFTWARE ENGINEERING (SOFTWARE TOOLS)

EFFORT BLOCK TITLE: SOFTWARE ASSERTION TECHNIQUES

OBJECTIVE: DEVELOP PROGRAM ASSERTION TECHNIQUES FOR IMPROVED SOFTWARE TESTING.

TECHNICAL APPROACH:

- INVESTIGATE PROGRAM ASSERTION METHODOLOGY FOR AUTOMATED TEST TOOLS.
- DEVELOP SUITABLE ASSERTION METHODS COMPATIBLE WITH KNOWN TESTING METHODS.
- VALIDATE TECHNIQUES USING AUTOMATED VERIFICATION SYSTEM (E.G. CAVS).

PAY OFF:

- IMPROVED SOFTWARE TESTABILITY AND PERFORMANCE.
- DYNAMIC TESTING OF SOFTWARE SYSTEMS SUPPORTED.
- HIGHER QUALITY OF DELIVERED PRODUCT.

TPO/THRUST #/TITLE: 46 INFORMATION PROCESSING

SUB-THRUST #/TITLE: 463 SOFTWARE ENGINEERING (SOFTWARE TOOLS)

EFFORT BLOCK TITLE: DISTRIBUTED PROCESSING TOOLS DEFINITION

OBJECTIVE: TO IDENTIFY/SPECIFY TOOLS AND TECHNIQUES TO SUPPORT THE DEVELOPMENT OF
DISTRIBUTED PROCESSING SYSTEMS.

TECHNICAL APPROACH:

- INVESTIGATE ATTRIBUTES OF DISTRIBUTED PROCESSING SYSTEMS AND APPLICABILITY OF
EXISTING TOOLS.
- DEFINE IMPROVED METHODS FOR ALLOCATION OF SYSTEM FUNCTIONS.
- IDENTIFY NEEDS FOR NEW PROGRAMMING STRATEGIES.
- PROVIDE FUNCTIONAL REQUIREMENTS FOR NECESSARY TECHNOLOGY DEVELOPMENTS.

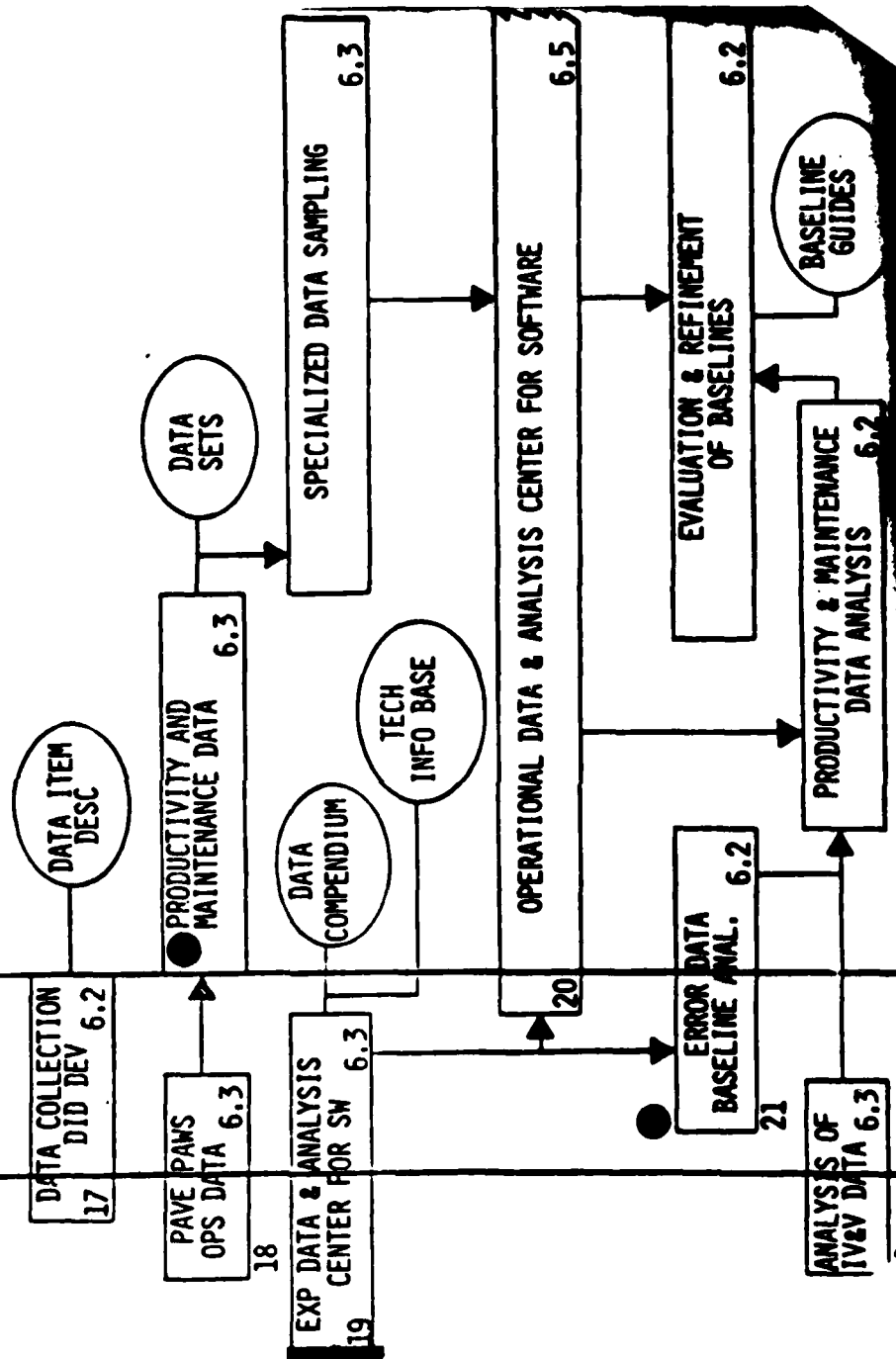
PAY OFF:

- COHERENT SOFTWARE DEVELOPMENT APPROACH FOR DISTRIBUTED PROCESSING.
- TECHNOLOGY TRANSFER OF EXISTING SOFTWARE ENGINEERING CAPABILITIES.

DATA COLLECTION

- ESTABLISH A FOCAL POINT CENTER FOR THE RECEIPT AND ANALYSIS OF SOFTWARE DATA FOR USE BY MANAGERS AND TECHNOLOGISTS.
- PROVIDE STANDARDIZED DATA COLLECTION METHODOLOGY.
- SUPPORT SOFTWARE ENGINEERING RESEARCH OBJECTIVES.

THRUST: 463 SOFTWARE ENGINEERING (DATA COLLECTION) (CONTD)



TPO/THRUST #/TITLE: 46 INFORMATION PROCESSING

SUB-THRUST #/TITLE: 463 SOFTWARE ENGINEERING (DATA COLLECTION)

EFFORT BLOCK TITLE: PRODUCTIVITY AND MAINTENANCE DATA

OBJECTIVE: TO ACQUIRE SOFTWARE DATA, ON A CONTINUING BASIS, TO SUPPORT SOFTWARE ENGINEERING RESEARCH OBJECTIVES.

TECHNICAL APPROACH:

- IDENTIFY DATA REQUIREMENTS - E.G. TO SUPPORT MODELING AND QUALITY REQUIREMENTS.
- SELECT APPROPRIATE PROJECTS FOR DATA COLLECTION.
- APPLY DATA ITEM DESCRIPTION FOR STANDARDIZED FORMAT ON DATA COLLECTION.

PAY OFF:

- ENABLE THE EVALUATION OF IMPROVED SOFTWARE ENGINEERING TECHNIQUES.
- PROVIDE DIRECTION FOR FUTURE RESEARCH ACTIVITIES.

TPO/THRUST #/TITLE: 4G INFORMATION PROCESSING

SUB-THRUST #/TITLE: 4G3 SOFTWARE ENGINEERING (DATA COLLECTION)

EFFORT BLOCK TITLE: ERROR DATA BASELINE ANALYSIS

OBJECTIVE: DEVELOP BASELINES TO TRACK AND ASSESS RELIABILITY OF SOFTWARE SYSTEMS
DURING DEVELOPMENT.

TECHNICAL APPROACH:

- UTILIZE DATA FROM EXPERIMENTAL DACS AND ANALYSIS OF IV&V DATA EFFORT.
- DEVELOP ERROR PROFILES AND BASELINES FOR CATEGORIZED C3I SYSTEMS.

PAY OFF:

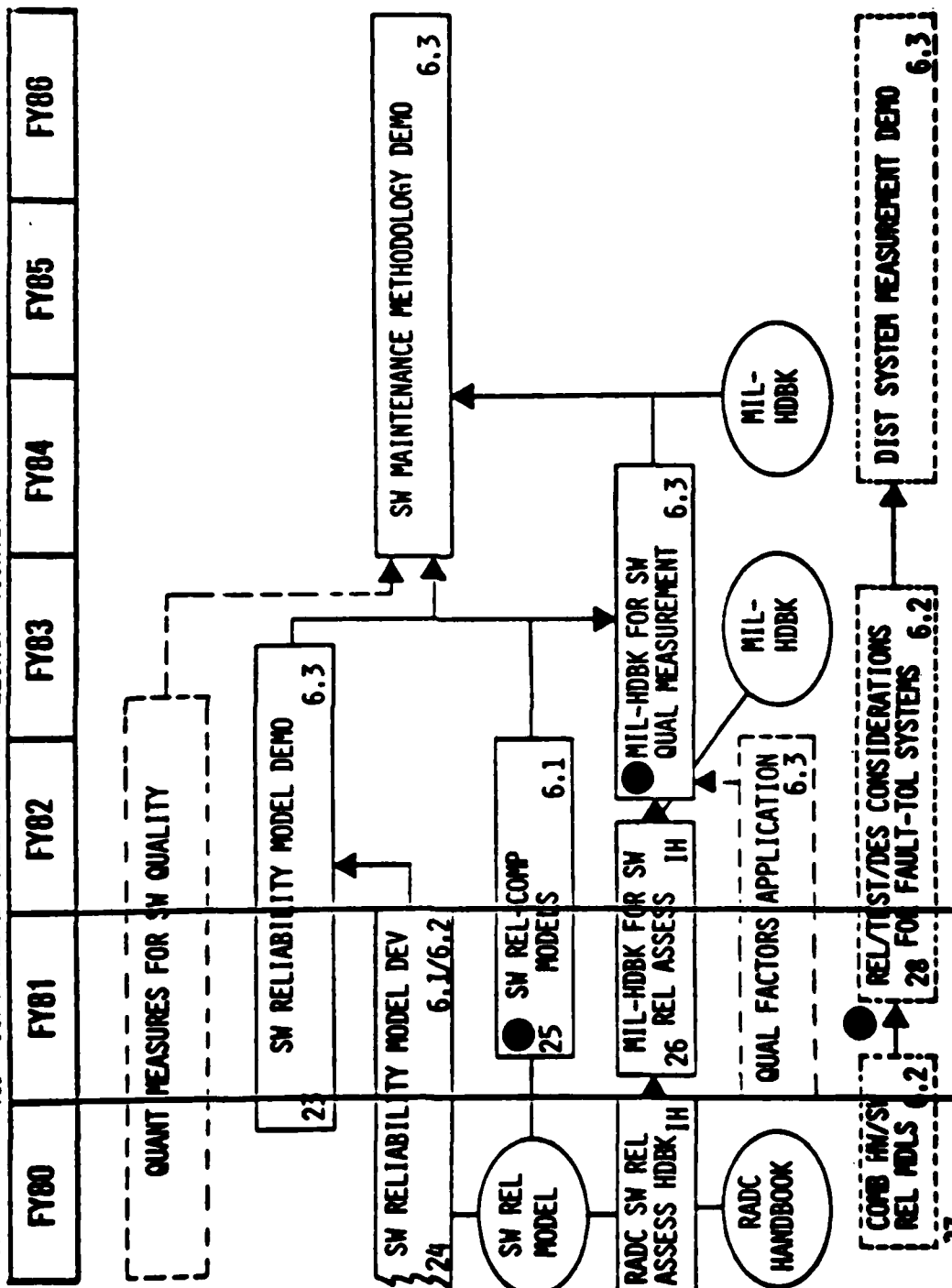
- PROVIDES CAPABILITY TO ASSESS IMPACT OF NEW SOFTWARE ENGINEERING TECHNOLOGY.
- IMPROVED REFERENCES FOR VALIDATING SOFTWARE QUALITY MEASUREMENTS.

MODELING

- PROVIDE A CAPABILITY TO PREDICT SYSTEM PERFORMANCE CHARACTERISTICS.
- ESTABLISH GUIDES, STANDARDS, AND SPECIFICATIONS FOR ASSESSING IMPLEMENTED SYSTEM PERFORMANCE DURING VARIOUS LIFE CYCLE PHASES.
- DEVELOP MODELS TO ASSIST SOFTWARE ENGINEERING RESEARCH.

RADC TPO 46 INFORMATION PROCESSING

THRUST: 463 SOFTWARE ENGINEERING (MODELING) (CONTD)



TPO/THRUST #/TITLE: 46 INFORMATION PROCESSING

SUB-THRUST #/TITLE: 463 SOFTWARE ENGINEERING (MODELING)

EFFORT BLOCK TITLE: SOFTWARE RELIABILITY-COMPLEXITY MODELS

OBJECTIVE: TO DEVELOP MODELS OF THE SOFTWARE DEVELOPMENT PROCESS THROUGH THE FORMULATION
OF INTEGRATED SOFTWARE RELIABILITY AND COMPLEXITY MODELS.

TECHNICAL APPROACH:

- EXAMINE SOFTWARE STRUCTURAL COMPLEXITY.
- RELATE COMPLEXITY TO SOFTWARE RELIABILITY AND DEVELOPMENT.

PAY OFF:

- CAPABILITY TO PERFORM RELIABILITY/COMPLEXITY TRADEOFFS.
- ASSISTANCE IN PERFORMING SOFTWARE TASK PARTITIONING.

TPO/THRUST #/TITLE: 46 INFORMATION PROCESSING

SUB-THRUST #/TITLE: 463 SOFTWARE ENGINEERING (MODELING)

EFFORT BLOCK TITLE: MIL-HDBK FOR SOFTWARE QUALITY MEASUREMENT

OBJECTIVE: DEVELOP MIL-HDBK FOR PERFORMING SOFTWARE QUALITY MEASUREMENTS.

TECHNICAL APPROACH:

- AUGMENT MIL-HDBK FOR SOFTWARE RELIABILITY ASSESSMENT WITH RESULTS FROM SOFTWARE QUALITY FACTORS APPLICATION.
- PRODUCE MIL-HDBK FOR SOFTWARE QUALITY MEASUREMENTS.

END OFF:

- CAPABILITY TO SPECIFY REQUIRED SOFTWARE QUALITY FACTORS (E.G. RELIABILITY).
- MIL-HDBK PROVIDES FOCUS ON SOFTWARE QUALITY.

TPO/THRUST #/TITLE: 46 INFORMATION PROCESSING

SUB-THRUST #/TITLE: 463 SOFTWARE ENGINEERING (MODELING)

EFFORT BLOCK TITLE: RELIABILITY/TEST/DESIGN CONSIDERATIONS FOR FAULT TOLERANT SYSTEMS.

OBJECTIVE: INVESTIGATE HARDWARE/SOFTWARE ASPECTS OF FAULT TOLERANT SYSTEMS TO IMPROVE RELIABILITY AND TESTABILITY.

TECHNICAL APPROACH:

- COMBINED HARDWARE/SOFTWARE MODELING ACTIVITY.
- DEVELOP NEW METHODS TO EVALUATE AND TEST FAULT TOLERANT SYSTEMS.
- JOINT DEVELOPMENT - RADC/IS AND RB.

PAY OFF: IMPROVED SYSTEM RELIABILITY AND TESTABILITY.

QUALITY MEASUREMENTS

- PROVIDE ACQUISITION MANAGEMENT WITH A CAPABILITY TO PREDICT COST/QUALITY/PERFORMANCE TRADEOFFS.
- ESTABLISH THE PROPER METRICS AND TOOLS FOR QUALITATIVE AND QUANTITATIVE ANALYSIS OF SOFTWARE SYSTEMS.
- DEVELOP AUTOMATED TOOLS FOR COLLECTING AND ANALYZING METRIC DATA AND VALIDATE THE RESULTS.

THRUST: 463 SOFTWARE ENGINEERING (QUALITY MEASUREMENTS) (CONTD)761

TPO/THRUST #/TITLE: 46 INFORMATION PROCESSING

SUB-THRUST #/TITLE: 463 SOFTWARE ENGINEERING (QUALITY MEASUREMENTS)

EFFORT BLOCK TITLE: QUANTITATIVE MEASURES FOR SOFTWARE QUALITY

OBJECTIVE: TO DEVELOP SPECIFIC METRICS OF SOFTWARE ATTRIBUTES AND INTERRELATIONSHIPS OF QUALITY FACTORS SUCH AS MAINTAINABILITY, REUSABILITY, INTEROPERABILITY, ETC.

TECHNICAL APPROACH:

- ANALYZE APPLICATION ENVIRONMENTS AND CLASSIFY SOFTWARE DEVELOPMENTS.
- EMPIRICAL DATA ANALYSIS TO DETERMINE SOFTWARE QUALITY MEASURES.
- CRITICAL SOFTWARE ATTRIBUTES SPECIFIED.

PAY OFF:

- IMPROVED UNDERSTANDING OF SOFTWARE QUALITY METRICS.
- ABILITY TO MATCH SOFTWARE METRICS TO DESIRED SYSTF^m FEATURES (E.G. PORTABILITY).

TPO/THRUST #/TITLE: 46 INFORMATION PROCESSING

SUB-THRUST #/TITLE: 463 SOFTWARE ENGINEERING (QUALITY MEASUREMENTS)

EFFORT BLOCK TITLE: COLLECTION AND ANALYSIS TOOLS

OBJECTIVE: IMPLEMENT AUTOMATED DATA COLLECTION AND ANALYSIS TOOLS FOR PERFORMING
SOFTWARE QUALITY MEASUREMENTS.

TECHNICAL APPROACH:

- UTILIZE PROTOTYPE COBOL TOOL FOR DATA COLLECTION.
- INITIAL VALIDATION OF MEASUREMENTS AND TEST RESULTS.
- DEVELOP METHODS FOR PREDICTING SOFTWARE QUALITY.

PAY OFF: IMPROVED SOFTWARE QUALITY ASSURANCE.

TPO/THRUST #/TITLE: 46 INFORMATION PROCESSING

SUB-THRUST #/TITLE: 463 SOFTWARE ENGINEERING (QUALITY MEASUREMENTS)

EFFORT BLOCK TITLE: MEASUREMENT VALIDATION

OBJECTIVE: TO APPLY AND DEMONSTRATE SOFTWARE QUALITY MEASUREMENT TOOLS IN AN AIR FORCE ACQUISITION PROGRAM.

TECHNICAL APPROACH:

- CANDIDATE COBOL PROJECT SELECTED (H6107/GCOS ENVIRONMENT).
- COLLECT AND ANALYZE METRIC DATA USING PROTOTYPE TOOL.

PAY OFF:

- CAPABILITY TO PREDICT AND ASSESS SOFTWARE QUALITY.
- VALIDATED COLLECTION TOOL TO PROVIDE R&D BASIS FOR ADDITIONAL TOOLS FOR VARIOUS PROGRAMMING LANGUAGES.

TPO/THRUST #/TITLE: 46 INFORMATION PROCESSING

SUB-THRUST #/TITLE: 463 SOFTWARE ENGINEERING (QUALITY MEASUREMENT)

EFFORT BLOCK TITLE: QUALITY FACTORS APPLICATION

OBJECTIVE: PROVIDE A CAPABILITY FOR ACQUISITION MANAGEMENT TO SPECIFY SOFTWARE QUALITY.

TECHNICAL APPROACH:

- DEMONSTRATE INTERACTION BETWEEN VARIOUS SOFTWARE QUALITY FACTORS.
- SURVEY C3I ENVIRONMENT TO PRIORITIZE QUALITY REQUIREMENTS.
- CONDUCT TRADE-OFF STUDIES OF CRITICAL SOFTWARE ATTRIBUTES.
- PRODUCE A QUALITY REQUIREMENTS GUIDEBOOK.

PAY OFF:

- EFFECTIVE SPECIFICATION OF KEY SOFTWARE QUALITY REQUIREMENTS.
- GUIDANCE DIRECTLY USABLE BY MANAGEMENT.
- MEANS FOR ASSURING ADHERENCE TO QUALITY REQUIREMENTS.

INDUSTRY LOOKS AT RADIC 1980

SOFTWARE ENGINEERING

TPO 463

<u>AREA</u>	<u>PROGRAM MANAGER</u>	<u>SYMBOL/PHONE</u>
REQUIREMENTS SPECIFICATION ENGINEERING	W. PZEPKA	ISIE/7834
SOFTWARE DESIGN	P. WERER	ISIE/7834
MANAGEMENT	A. SUKERT	ISIS/3851
SOFTWARE TOOLS	F. LAMONICA	ISIE/7834
DATA COLLECTION	J. PALAIMO	ISIS/4325
MODELING	A. SUKERT	ISIS/3851
QUALITY MEASUREMENTS	J. CAVANO	ISIS/4325

ELECTROMAGNETIC COMPATIBILITY

- CONTROL - T. BAUSTERT
- ANALYSIS & PREDICTION - G. CAPRARO

EMC CONTROL

OBJECTIVE:

**DEVELOP ADVANCED CONTROL/SUPPRESSION TECHNIQUES
TO ALLEVIATE INTERFERENCE PROBLEMS NOT SOLVABLE BY
CONVENTIONAL TECHNIQUES**

TPO/THRUST #/TITLE:	4F	RELIABILITY, MAINTAINABILITY & COMPATIBILITY
SUB-THRUST:	4F3	EM COMPATIBILITY - CONTROL
BLOCK TITLE:	EMC TECHNOLOGY FOR ADVANCED COMMUNICATIONS	12
OBJECTIVE:	ADVANCE ELECTRONICALLY TUNABLE RESONATOR (ETR) TECHNOLOGY	
TECHNICAL APPROACH:	●	HIGH POWER SUB-BAND UHF COVERAGE ETR
	●	MEDIUM POWER FULL BAND COVERAGE ETR
PAY OFF:	IMPROVED COLLOCATION ON C ³ I PLATFORMS	

TPO/THRUST #/TITLE:	4F RELIABILITY, MAINTAINABILITY & COMPATIBILITY
SUB-THRUST:	4F3 EM COMPATIBILITY - CONTROL
BLOCK TITLE:	ADVANCED SYNTHESIZER EMC TECHNOLOGY 13
OBJECTIVE:	DEVELOP ELECTRONICALLY TUNABLE OSC (ETO) TECHNOLOGY FOR NEW SYNTHESIZER APPLICATION
TECHNICAL APPROACH:	<ul style="list-style-type: none"> ● PROVE FEASIBILITY OF HIGH LEVEL/LOW NOISE ETO ● USE ETO TECH TO DEVELOP A Ø LOCKED LOOP SYNTHESIZER
PAY OFF:	<ul style="list-style-type: none"> ● REDUCE XMTR NOISE/SPURIOUS OUTPUTS ● REDUCE RCVR GUARDBANDS ● PROVIDE TECH SPIN-OFF TO TEST EQUIPMENT

TPO/THRUST #/TITLE:	4F RELIABILITY, MAINTAINABILITY & COMPATIBILITY
SUB-THRUST:	4F3 EM COMPATIBILITY - CONTROL
BLOCK TITLE:	HF ANTENNA COUPLER EMC TECHNOLOGY
OBJECTIVE:	DEVELOP TECHNOLOGY TO REDUCE ANTENNA COUPLER NONLINEAR INTERFERENCE
TECHNICAL APPROACH:	<ul style="list-style-type: none"> • IDENTIFY INTERFERENCE MECHANISM • REDUCE INTERFERENCE BY DESIGN • DEVELOP ADD-ON DEVICE
PAY OFF:	HF XMTR/AFSATCOM EMC WITHOUT FREQUENCY MANAGEMENT

TPO/THRUST #/TITLE:	4F RELIABILITY, MAINTAINABILITY & COMPATIBILITY
SUB-THRUST:	4F3 EM COMPATIBILITY - CONTROL
BLOCK TITLE:	EMC TECHNOLOGY FOR REDUCING NONLINEAR INTERFERENCE 16
OBJECTIVE:	DEVELOP TECHNOLOGY TO IDENTIFY AND REDUCE NONLINEAR GENERATED INTERFERENCE
TECHNICAL APPROACH:	<ul style="list-style-type: none"> ● STUDY MECHANISMS AND ID TECHNIQUES ● NONLINEAR CANCELLATION TECHNIQUE ● ADAPT Ø CONTROL ● NONLINEAR SYNTHESIS
PAY OFF:	COLLOCATION OF ULTRA SENSITIVE RCVRs ON C ³ I PLATFORMS

TPO/THRUST #/TITLE:

4F RELIABILITY, MAINTAINABILITY & COMPATIBILITY

SUB-THRUST:

4F3 EM COMPATIBILITY - CONTROL

BLOCK TITLE:

COMPUTER AIDED EMC DESIGN TECHNIQUES 17

OBJECTIVE:

DEVELOP GENERALIZED PRINTED CIRCUIT LAYOUT, GROUNDING
AND BY-PASS TECHNIQUES TO REDUCE UNWANTED COUPLING PATHS

TECHNICAL APPROACH:

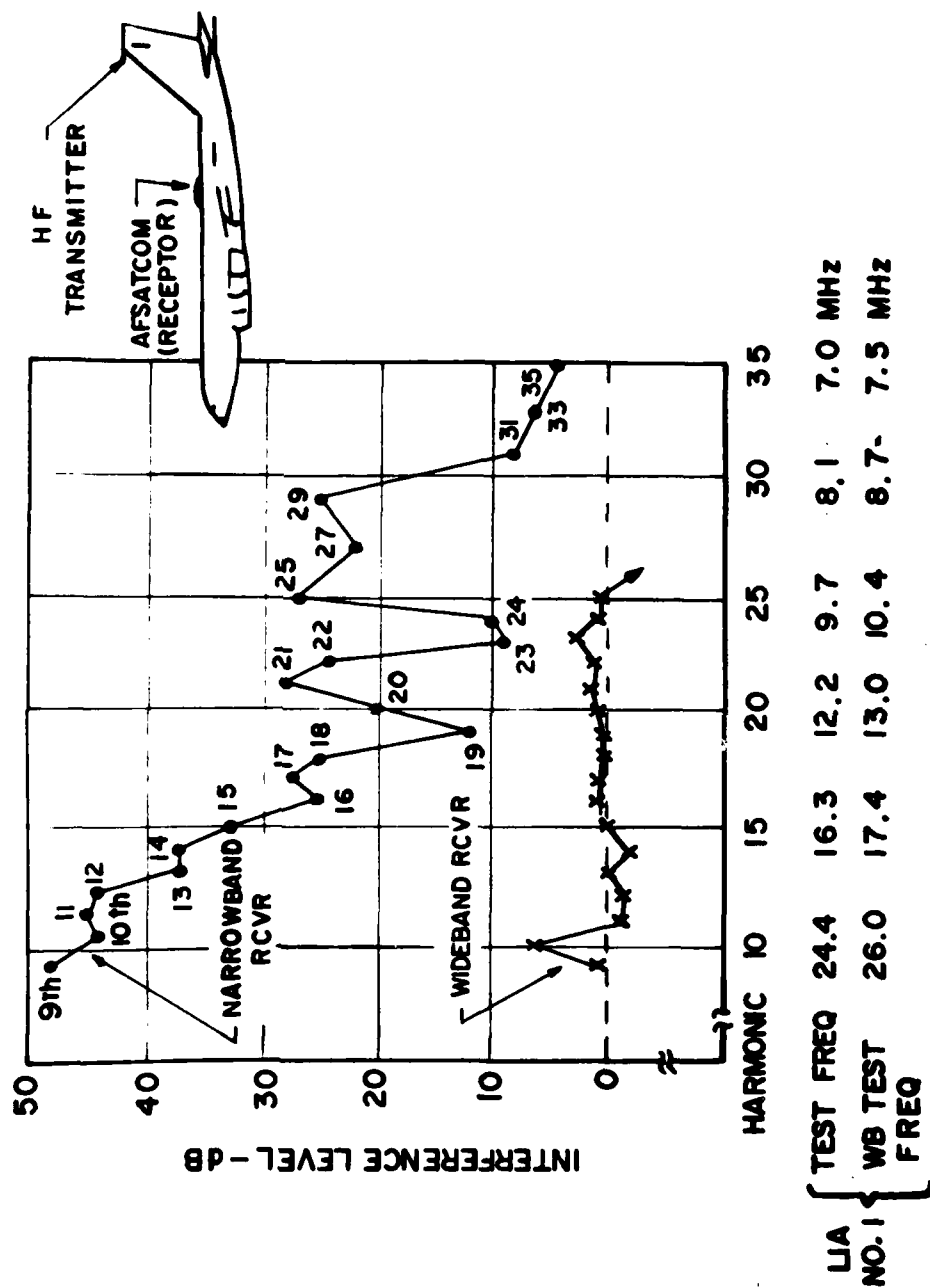
INVESTIGATE UNWANTED COUPLING MECHANISMS AND PROVIDE
COMPUTER AIDED DESIGN ALTERNATIVES

PAY OFF:

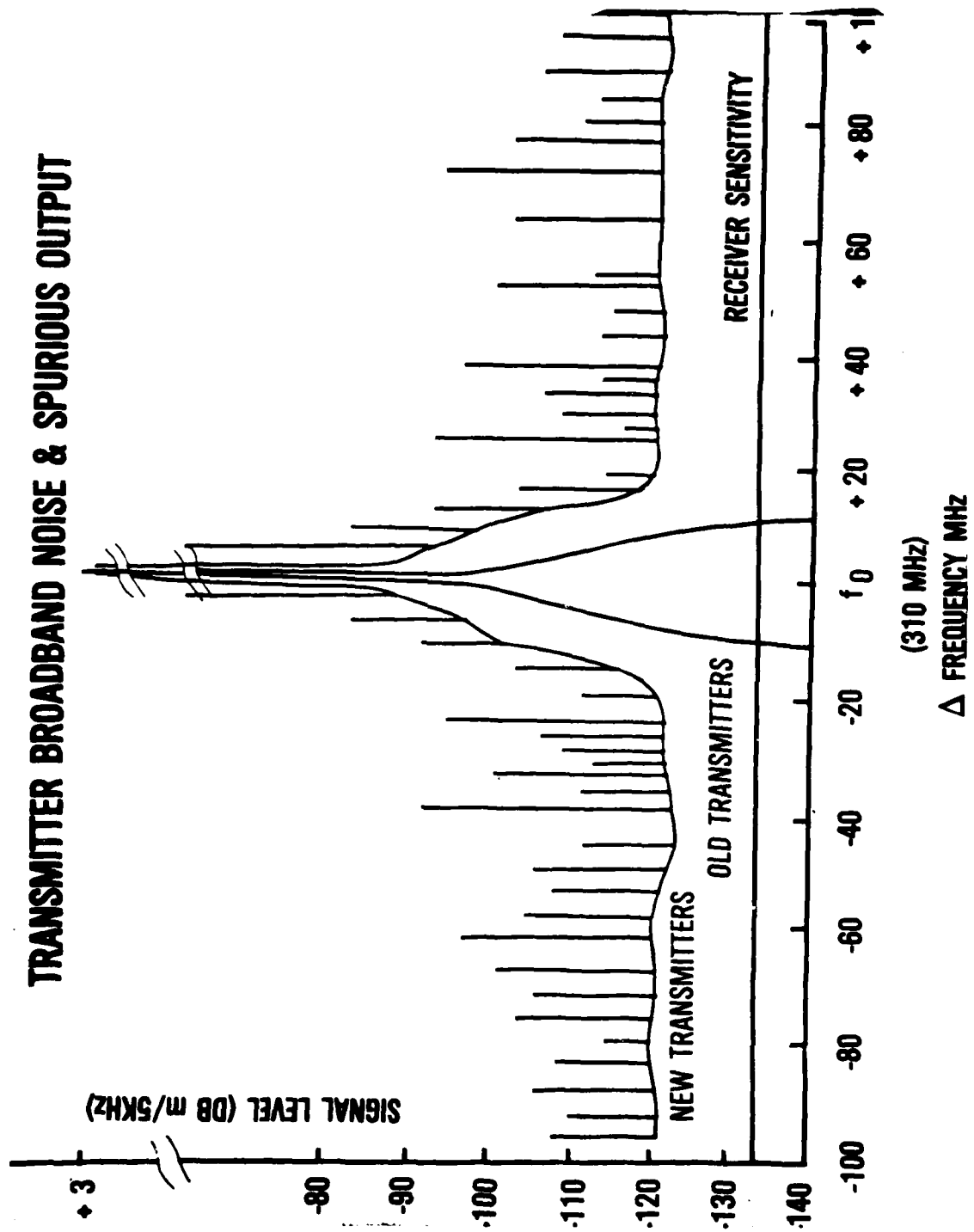
● HANDHELD CALCULATOR PROGRAMS

● UPDATE AFSC DH 1-4 EMC

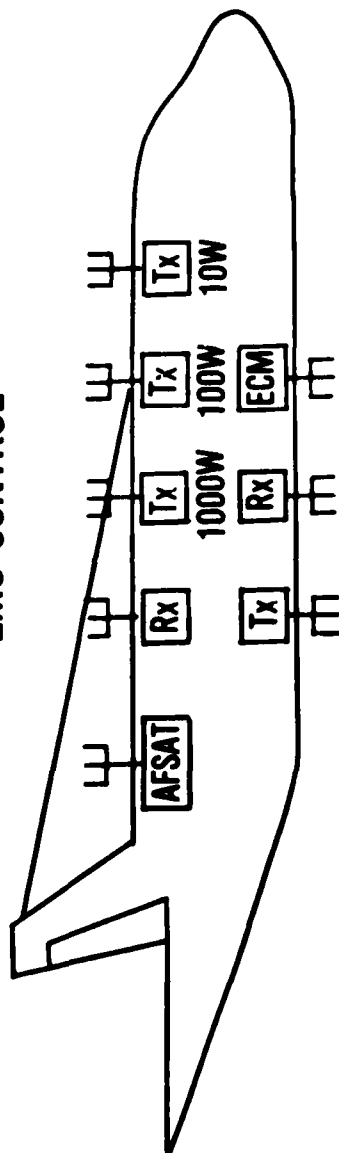
AN/ARC-58 LIAISON NO.1 AS A SOURCE



TRANSMITTER BROADBAND NOISE & SPURIOUS OUTPUT



EMC CONTROL



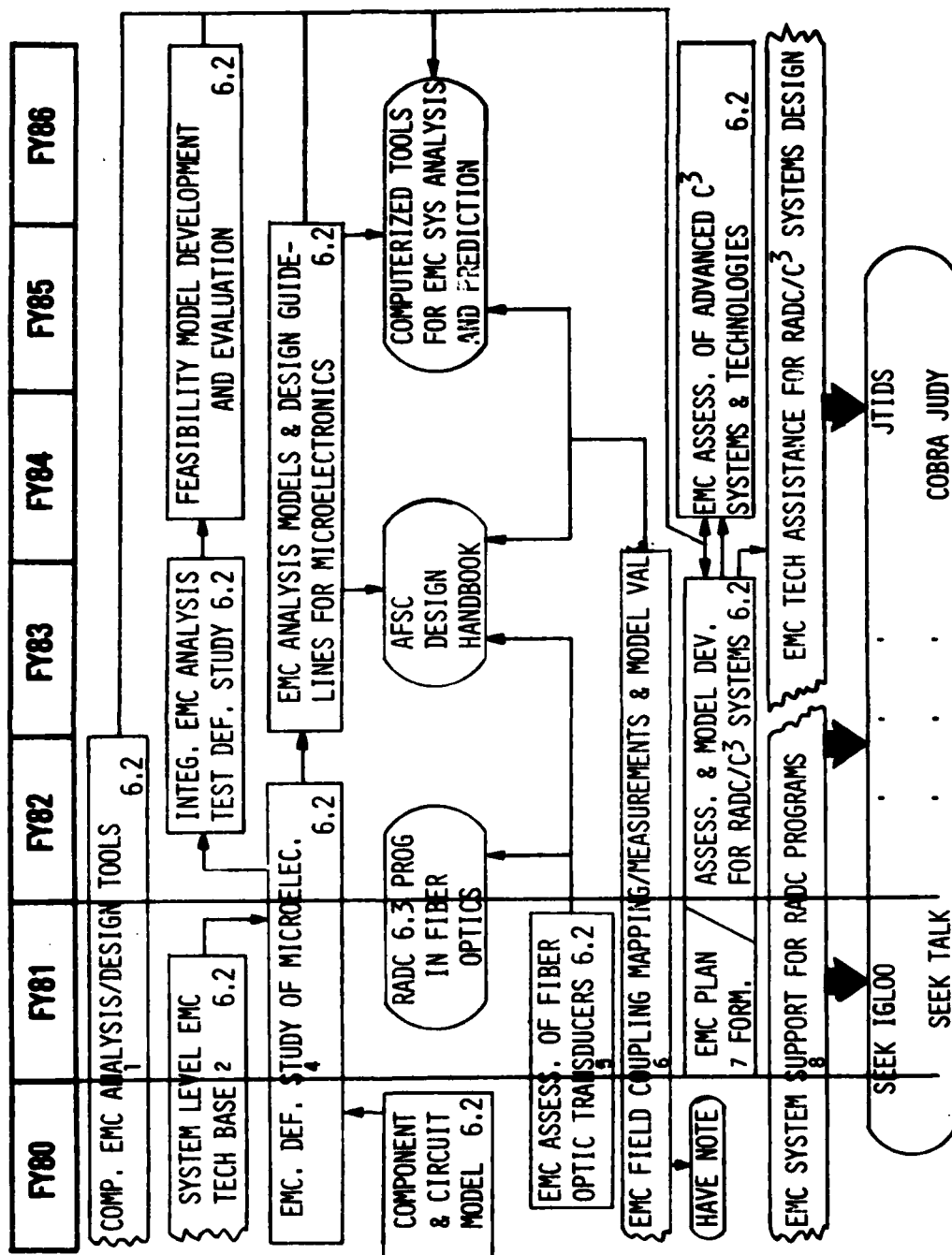
<u>Tx OUTPUTS</u>	<u>MEDIUM</u>	<u>Rx INPUTS</u>	<u>Rx OUTPUT</u>
<ul style="list-style-type: none"> • DESIRED OUTPUT • NOISE • SPURIOUS • HARMONICS • IM PRODUCTS 	<ul style="list-style-type: none"> • DIRECT PATH • REFLECTED PATH • FUSELAGE • NON-LINEAR • APERTURES 	<ul style="list-style-type: none"> • DESIRED SIGNAL • BRUTE FORCE • NOISE • SPURIOUS • HARMONICS • IM PRODUCTS 	<ul style="list-style-type: none"> • L.O. SIGNAL • SPURIOUS • IM PRODUCTS • HARMONICS

EMC ANALYSIS, PREDICTION AND MEASUREMENT

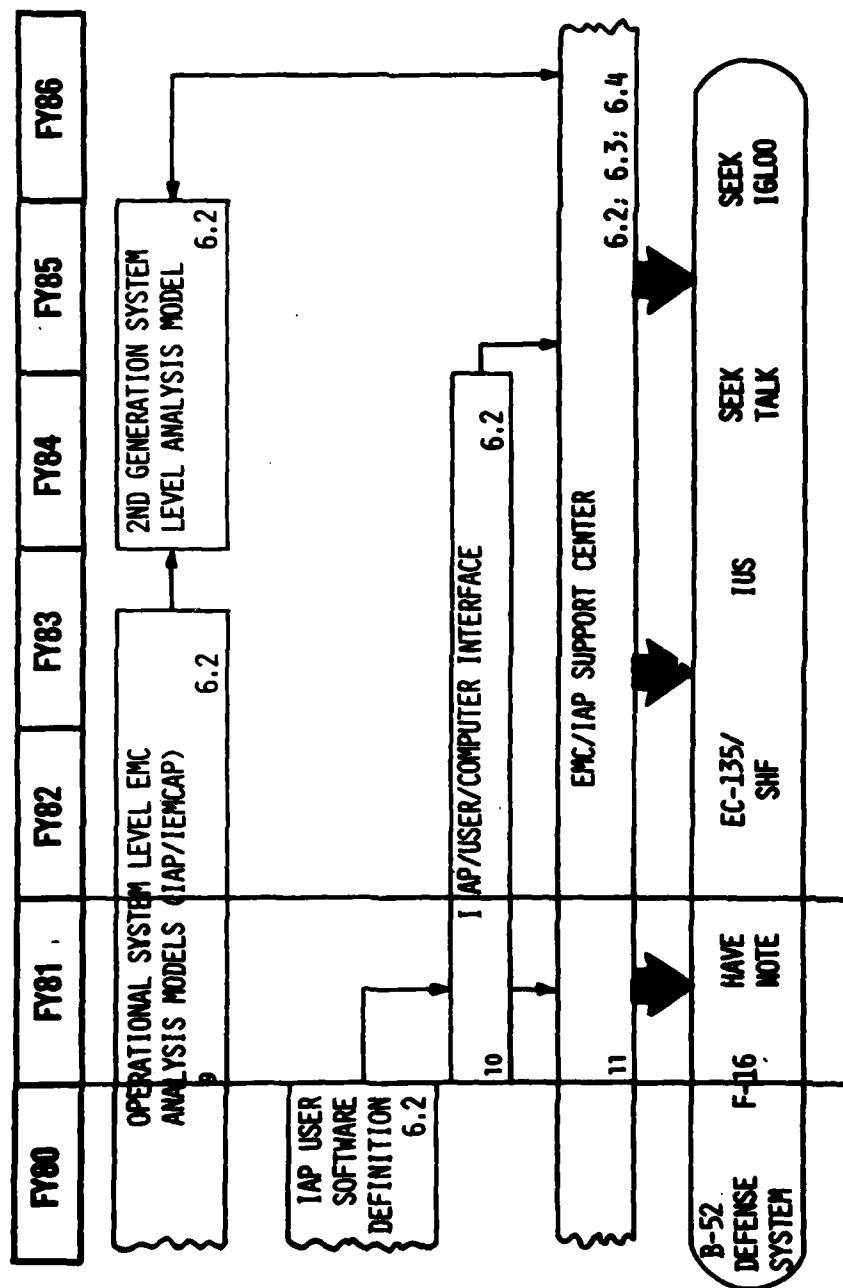
THE OBJECTIVE OF THIS TECHNICAL AREA IS:

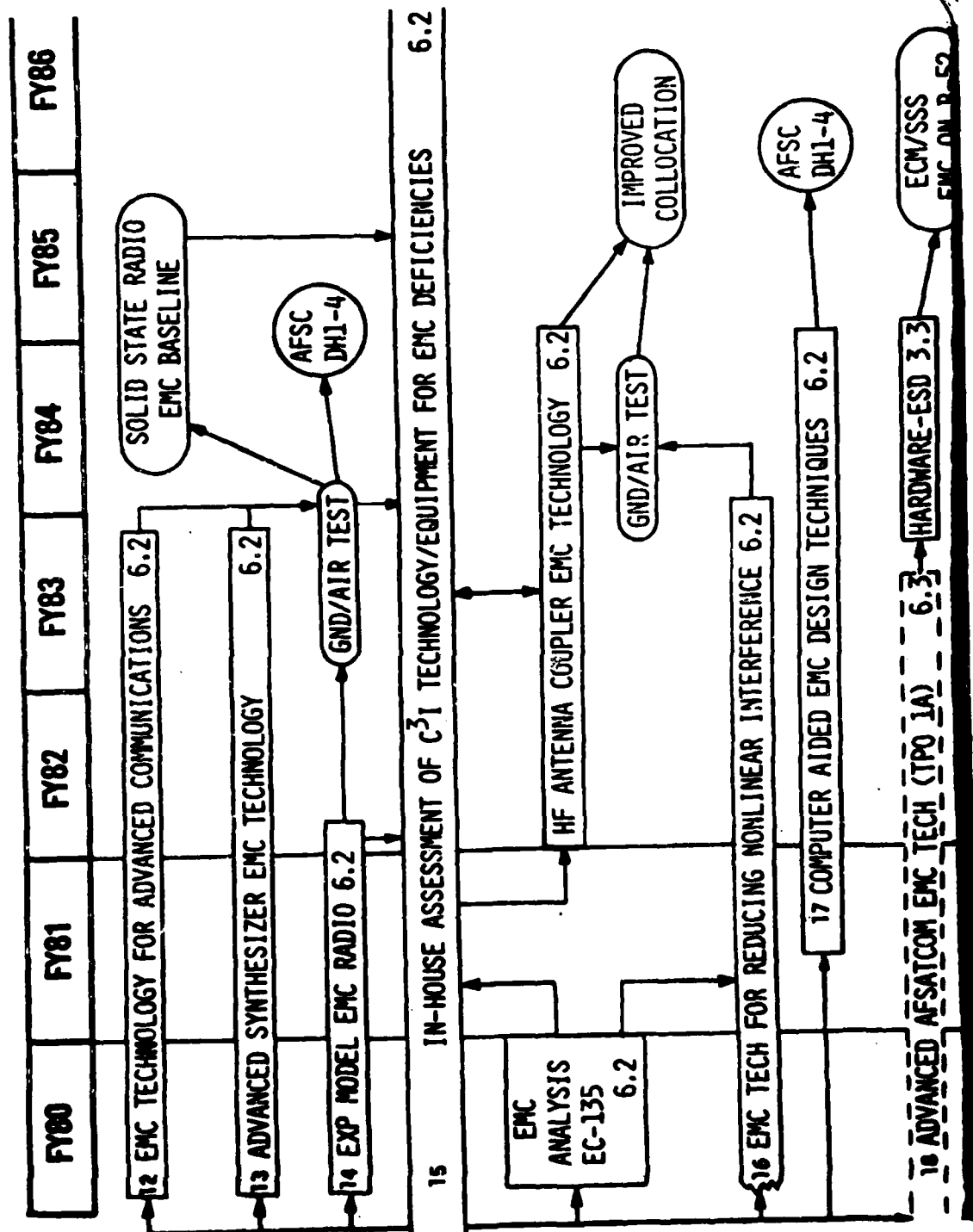
1. TO CONDUCT LONG RANGE CONTINUING RESEARCH AND SYSTEM'S ANALYSIS FOR USE IN DEVELOPING RECOMMENDATIONS AND TECHNIQUES TO EFFICIENTLY UTILIZE THE EM SPECTRUM IN A COMPATIBLE MANNER.
2. TO EMPHASIZE RESEARCH, DEVELOPMENT, TEST AND EVALUATION EVOLVING MODELING TECHNIQUES FOR COMPONENTS, CIRCUITS, EQUIPMENTS, SUB-SYSTEMS AND SYSTEMS DESIGN THROUGHOUT THEIR LIFE CYCLE.
3. TO ENSURE THE EFFICIENT AND BROAD EXCHANGE OF THE INFORMATION OBTAINED REGARDING THE RESULTS OF THIS AREA.

RADC TPO



RADC TPO 4F3 - EM COMPATIBILITY





TPO/THRUST. #/TITLE: 4F RELIABILITY, MAINTAINABILITY & COMPATIBILITY
 SUB-THRUST #/TITLE: 4F3 EM COMPATIBILITY
 BLOCK TITLE: EMC DEFINITION STUDY OF MICROELECTRONICS 4
 OBJECTIVE:

- DETERMINE EM SUSCEPTIBILITY OF USAF MICROELECTRONIC CIRCUITRY
- ESTABLISH INTERFERENCE MECHANISMS
- DEVELOP USABLE ANALYTICAL MODELS AND/OR DESIGN GUIDELINES

 TECHNICAL APPROACH:

- ANALYTICAL/EXPERIMENTAL INVESTIGATION
- ESTABLISH & DEFINE MODELING LEVEL
- DEVELOP MULTI-PARAMETER SUSCEPTIBILITY MODEL
- STUDY IMPACT TO C³ SYSTEMS VIA COMPUTER MODELS AND DESIGN HANDBOOKS
- IMPLEMENT ONE OR MORE MODELS IN SOFTWARE AND IN HANDBOOKS

 PAY OFF: PREDICTION/ANALYSIS COMPUTER MODELS FOR MICROELECTRONICS AND C³ SYSTEMS; REDUCED EMC COSTS; EMC DESIGN PROCEDURES FOR MICROELECTRONICS

TPO/THRUST #/TITLE:	4F RELIABILITY, MAINTAINABILITY & COMPATIBILITY
SUB-THRUST #/TITLE:	4F3 EM COMPATIBILITY
BLOCK TITLE:	INTEGRATED EMC ANALYSIS/TEST DEFINITION STUDY
OBJECTIVE:	DEFINE INTERFACING OF EMC MEASUREMENTS, COMPUTERIZED ANALYSIS TOOLS, AND THEIR RESPECTIVE DATA
TECHNICAL APPROACH:	<ul style="list-style-type: none"> ● DEFINE BOX LEVEL MEASUREMENT HARDWARE AND SOFTWARE ● DEFINE SYSTEM LEVEL MEASUREMENT HARDWARE AND SOFTWARE ● DEFINE INTERFACING OF BOX AND SYSTEM LEVEL DATA WITH ANALYSIS TOOLS
PAY OFF:	<ul style="list-style-type: none"> ● EFFICIENT DATA GATHERING PROCEDURES ● EFFICIENT DATA UTILIZATION ● MORE EM COMPATIBLE WEAPON SYSTEMS

TPO/THRUST #/TITLE: 4F RELIABILITY, MAINTAINABILITY & COMPATIBILITY

SUB-THRUST #/TITLE: 4F3 EM COMPATIBILITY

BLOCK TITLE: EMC FIELD COUPLING MAPPING/MEASUREMENTS & MODEL VALIDATION 6

OBJECTIVE:

- DEMONSTRATE CAPABILITIES & DEFINE LIMITS OF FINITE DIFFERENCE TIME DOMAIN (FDTD)/COUPLING INTO MISSILES
- INTERFACE ADVANCED COUPLING TECHNIQUES
- MEASURE E&H FIELDS IN MISSILES

TECHNICAL APPROACH:

- MODEL ARBITRARY ANGLES OF INCIDENCE & POLARIZATION
- MODEL WIRES BEHIND APERTURES
- DEVELOP INTERFACE SOFTWARE TECHNIQUES
- DEVELOP E&H FIELD PROBES WITH ACCURACY OF ± 1 DB AND SPATIAL RESOLUTION OF ± 0.5 CM

PAY OFF: ACCURATE TECHNIQUES FOR PREDICTING/VERIFYING EM FIELDS INTO MISSILES

TPQ/THRUST #/TITLE:	4F RELIABILITY, MAINTAINABILITY & COMPATIBILITY
SUB-THRUST #/TITLE:	4F3 EM COMPATIBILITY
BLOCK TITLE:	OPERATIONAL SYSTEM LEVEL EMC ANALYSIS MODELS (IAP/IEMCAP) 9
OBJECTIVE:	UPGRADE IEMCAP CAPABILITY TO ADDRESS DEFICIENCIES SURFACED BY USERS, F-15 AND B-52 EVALUATIONS, & OTHER CURRENT & PROJECTED APPLICATIONS
TECHNICAL APPROACH:	DEVELOP, INCORPORATE INTO IEMCAP, AND DOCUMENT: <ul style="list-style-type: none"> ● IMPROVED SPECTRA AND RECEPTOR MODELS ● EFFECTS OF WIRE HANGERS, JUNCTION BOXES, BULKHEADS ● ANTENNA OUT-OF-BAND MODELS ● BUNDLE-TO-BUNDLE COUPLING ● NONLINEAR ANALYSIS ● BOX-TO-BOX COUPLING
PAY OFF:	HIGHLY IMPROVED TOOL FOR PRELIMINARY EMC ANALYSIS/DESIGN; REDUCE COSTLY EMC TESTS; PROVIDE STANDARD WEAPON SYSTEM EMC DATA BASE FOR FUTURE SYSTEM MODS

- **IEMCAP**

- **SUPPLEMENTAL MODELS**

P-STATIC

TEMPEST

MAGNETOSPHERIC SUBSTORMS

LIGHTNING

- **OFF-LINE MODELS**

NONLINEAR CIRCUIT ANALYSIS

EM FIELDS AND COUPLING ANALYSIS

WIRE COUPLING ANALYSIS

- **EM IMPACT OF ADVANCED COMPOSITE MATERIALS**

IAP TRAINING
TOTAL OF 195 STUDENTS REPRESENTING

Aerojet Electro Systems Co	General Electric	MMC
Aeroneutronics Ford	Georgia Institute of Technology	Northrop Corp
Aerospace Corp	Gumman	Pacific Missile Test Center
AFAL	GTE Sylvaia	Purdue Univ
AFATL	Harris ESD	RADC
AFCS	Hughes Aircraft	Rand
AFDDL	IBM	Raychem
AFGL	IIT Research Inst	Raytheon
AFLC	IRT Corp	RCA Corporation
AFSC	Israel-Defense Ministry	Rockwell Intl
AFWL	Lockheed	Sachs-Freeman Associates
ALC	Loral Electronic Systems	Samsco
ASD	Martin-Marietta	Sandia Laboratories
Atlantic Research Corp	Mitre	Southwest Research Inst
Bell Northern Research	Motorola	Sperry Univac
Boeing	NADC	Stanford Research Inst
Collins	NASA-Goddard Space Center	Systematics General Corp
Concordia Univ	National Aerospace Lab	Teledyne-Ryan-Aeronautical
Dayton T. Brown Inc	NATC	TRW
Def. Research Est-Ottawa	NAVSEC	USA CEEIA
ECAC	Naval Electronics Lab Center	USA CRDC
ESD	NASC	USA DAVAA-E
Fairchild Space & Electronics	NRL	USAF
General Dynamics	NSWC	US Dept of Commerce
	NUSC	Vought Corp
		Western Electric
		Westinghouse Electric Corp

AGENCIES/
COMPANIES POSSESSING IAP CODES

Aerojet Elec Systems Co	IBM	Sylvania
AIL-Cutler Hammer	IIT Research Inst.	Systematics General Corp
Atlantic Research Corp	IRT Corp	TRW
Belden Corp	Israel Aircraft Industry	Vought Corp
Bell Aerospace Textron	Jet Propulsion Lab	Western Electric
Bell Helicopter	Litton	Westinghouse Elec. Corp
Boeing	Lockheed	ADTC
Seattle	Burbank	Aerospace
Wichita	Marietta	AFAL
British Defense Staff	Sunnyvale	AFATL
Collins Radio	Loral Electronic Systems	AFFDL
Cedar Rapids	Los Alamos Scientific Lab	AFGL
Newport Beach	Magnavox	ASD
Control Data Corp	Martin Marietta Corp	Dept of Commerce
Defense Research Est	McDonnell Douglas	ECAC
Fairchild Space & Elec Co	St Louis	ESD
General Dynamics	Long Beach	Mitre
Fort Worth	Mitre Corp	Navalr
Pomona	Motorola	Naval Air Development Center
San Diego	Northrup	Naval Air Test Center
General Electric	Pacific Missile Test Center	Naval Avionics Facility
Georgia Inst of Technology	Packard Electric	Naval Postgraduate School
Harris ESD	Purdue Univ	Naval Research Lab
Hughes Aircraft	RCA	Naval Weapons Center
Culver City	R.C. Hansen Inc	Naval Surface Weapons Center
Los Angeles	Rockwell International	USACEIA
Grumman Aerospace Corp	Downey	USACRDC
	Seal Beach	
	Sanders Assoc	
Auburn University	Sandia Laboratories	
E-Systems, Inc	Southwest Research Inst	
Raychem Corporation	Sperry Univac	
University of Kentucky		

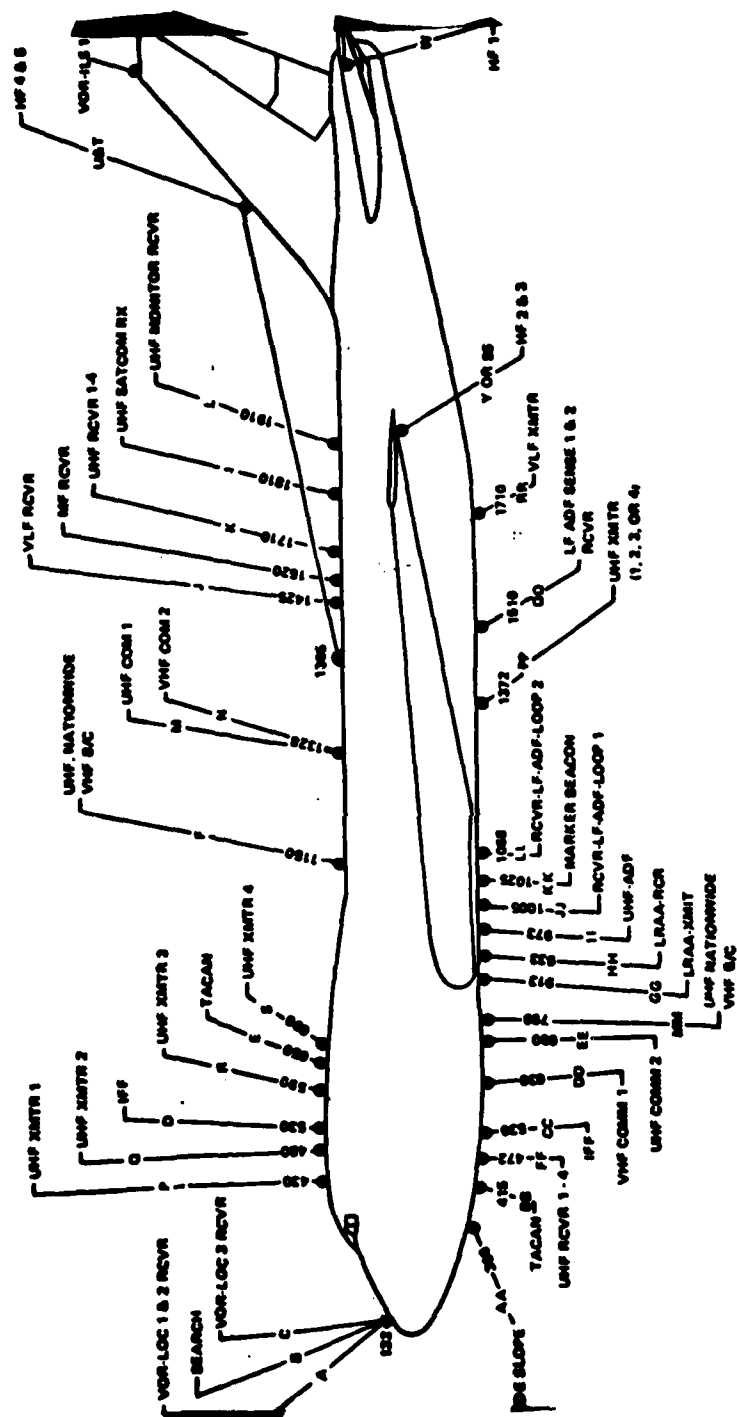


FIGURE 6-1B. E4-A BASELINE ANTENNA LOCATIONS - CONFIGURATION 2

TPO/THRUST #/TITLE: 4F RELIABILITY, MAINTAINABILITY & COMPATIBILITY

SUB-THRUST #/TITLE: 4F3 EM COMPATIBILITY

BLOCK TITLE: IAP/USER/COMPUTER INTERFACE 10

OBJECTIVE:

- DEFINE AREAS WHERE COMPUTER GRAPHICS CAN EFFECTIVELY INCREASE IAP USAGE
- FURTHER DEFINITION & DEVELOPMENT OF THE IAP OUTPUT DATA SYSTEM FILE HANDLER (SFH)
- DEVELOP AN IAP USER HANDBOOK FOR PROGRAM MANAGERS
- SURVEY GRAPHICS CAPABILITIES FOR IAP USER DATA VERIFICATION/ PLOTTING, STRUCTURE DESCRIPTION, ETC.
- DEVELOP SOFTWARE TO INTERFACE SFH WITH THE USER AND IAP DATA
- DEVELOP GUIDELINES FOR IAP ANALYSIS AND REQUIRED DELIVERABLES.

TECHNICAL APPROACH:

IMPROVE TECHNOLOGY TRANSFER MECHANISM AND INCREASE RETURN ON INVESTMENT OF EMC ANALYSIS RESOURCES

PAY OFF:

SUMMARY

● TECHNOLOGY ROADMAP

● IAP ROADMAP

● EMC/IAP SUPPORT CENTER

● KEY PERSONNEL

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GRIFFISS AFB NY 13441

ADDRESS:



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